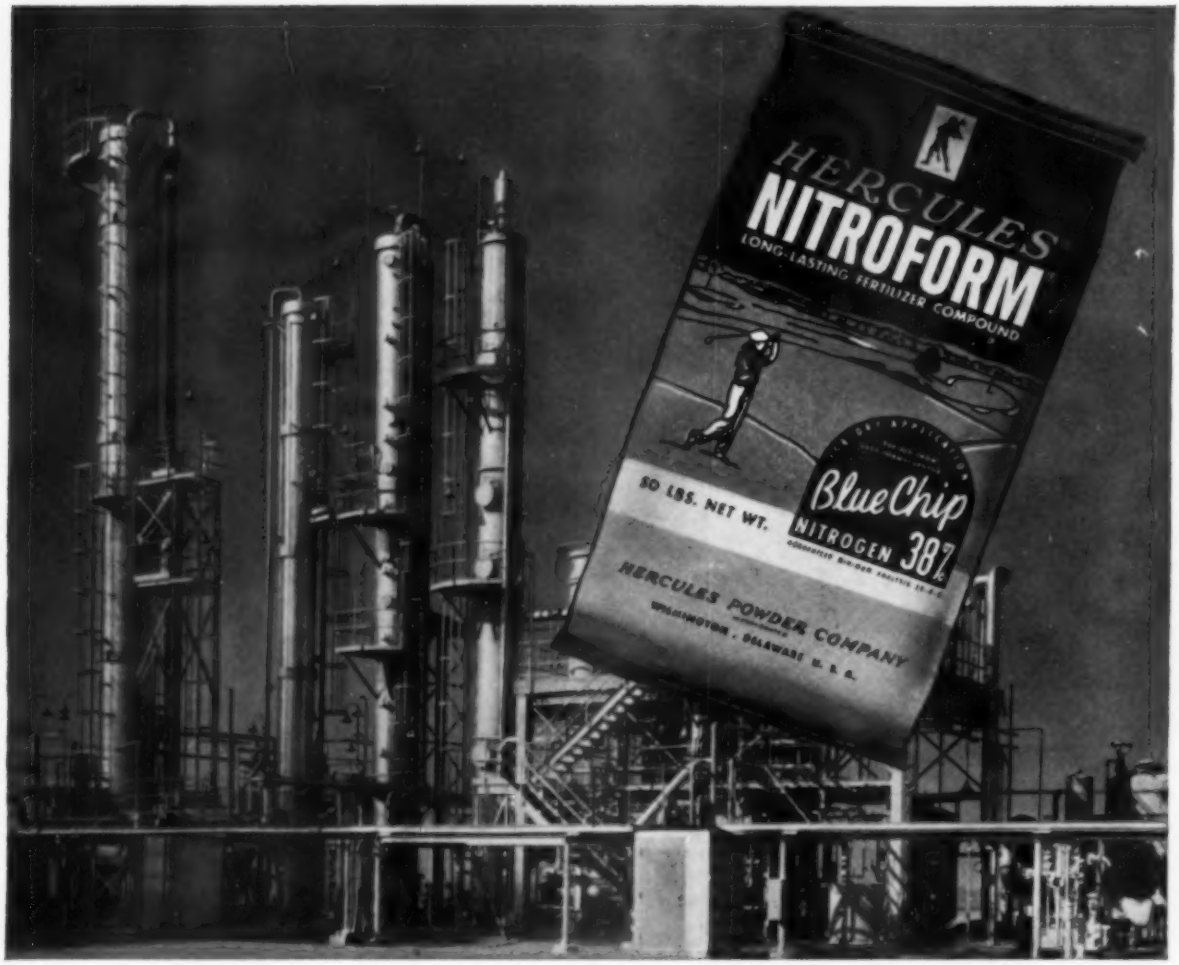
AGRICULTURAL CHEMICALS

In this issue:

May 1961



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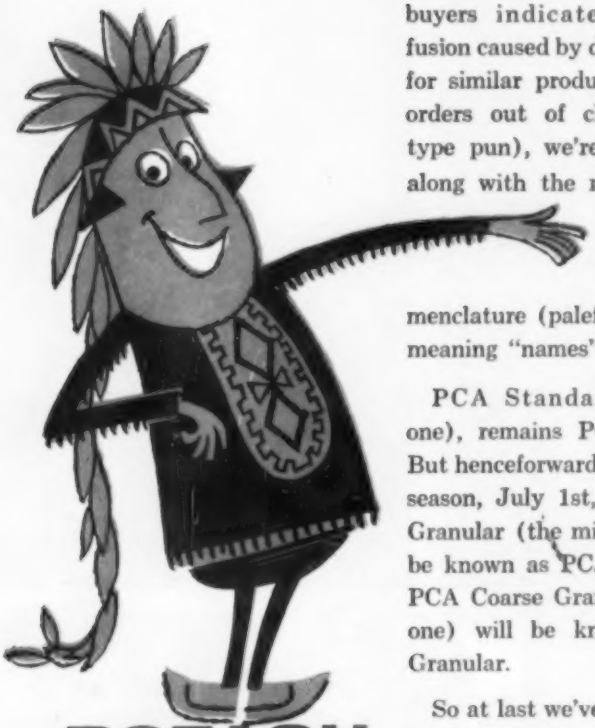

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This Month's Cover

The increasing use of pesticides by farmers in the United States is reflected on this month's cover, which shows a pesticide spray being applied. The use of pesticides is expected to increase tenfold during the next 20 years, according to a representative of the pesticide industry. Page 19. Some of the reasons for this are outlined in the report of a farmer's experiences with herbicides. Page 31.

AG CHEM

Vol. 16, No. 5 May, 1961

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INDUSTRY MEETING CALENDAR

May 17-18 — Chemical Market Research Association. 21st Annual Meeting. Plaza Hotel. New York.

June 5-7 — Southern Feed, Fertilizer, and Pesticide Control Officials. Annual Meeting. Lafayette Hotel. Lexington, Ky.

June 6-7 — Summer Meeting. Georgia Plant Food Educational Society. Wanderer Motel. Jekyll Island, Ga.

June 9-17 — European Congress of Chemical Engineers and ACHEMA Congress 1961. Frankfurt am Main, Germany.

June 11-14 — Annual convention. National Plant Food Institute. The Greenbrier, White Sulphur Springs, W. Va.

June 24 — Del-Mar-Va Peninsular Fertilizer Association, George Washington Hotel, Ocean City, Md.

June 27-29 — Twelfth Annual Fertilizer Conference of the Pacific Northwest. Marion Hotel. Salem, Oregon.

July 19-21 — Southwest Fertilizer Conference and Grade Hearing. Galvez Hotel, Galveston, Texas.

Aug. 7-9—Symposium on Pesticide Residues. 18th International Congress of Pure and Applied Chemistry. Montreal, Canada.

Aug. 27 - Sept. 1 — Annual Joint Meeting of Biological Societies. Purdue University, Lafayette, Ind.

Sep. 3-8 — 140th National Meeting. American Chemical Society, and National Chemical Exposition. Chicago.

Oct. 2-6—National Hardware Show. McCormick Place, Chicago.

Oct. 9-10 — Four-State Applicators & Chemical Conference. Chinook Motel and Tower, Yakima, Wash.

Oct. 9-11—Western Agricultural Chemicals Association. Annual Meeting. Hotel Claremont, Berkeley, Calif.

Oct. 20-22 — Eastern Lawn, Garden, and Allied Products Trade Show. Coliseum. New York.

Oct. 23-25 — Entomological Society of Canada, Entomological Society of Quebec, Joint Meeting, P.Q., Canada.

Oct. 29-Nov. 1 — National Agricultural Chemicals Association. 28th Annual Meeting. The Homestead. Hot Springs, Va.

Oct. 31-Nov. 2—National Fertilizer Solutions Association. Annual Convention. Edgewater Beach Hotel. Chicago.

Nov. 2-3 — Pacific Northwest Plant Food Association, annual convention. Hotel Gearhart, Gearhart, Oregon.

Nov. 6-7 — Annual Weed Conference. Washington State Weed Association. Chinook Motel and Tower, Yakima, Wash.

Nov. 7-10 — British Insecticide & Fungicide Conference, Brighton, England. Sponsored by Association of British Manufacturers of Agricultural Chemicals.

Nov. 8-10—Fertilizer Industry Round Table. Mayflower Hotel. Washington, D. C.

Nov. 12-14 — 38th Annual Convention of California Fertilizer Association. Jack Tar Hotel. San Francisco.

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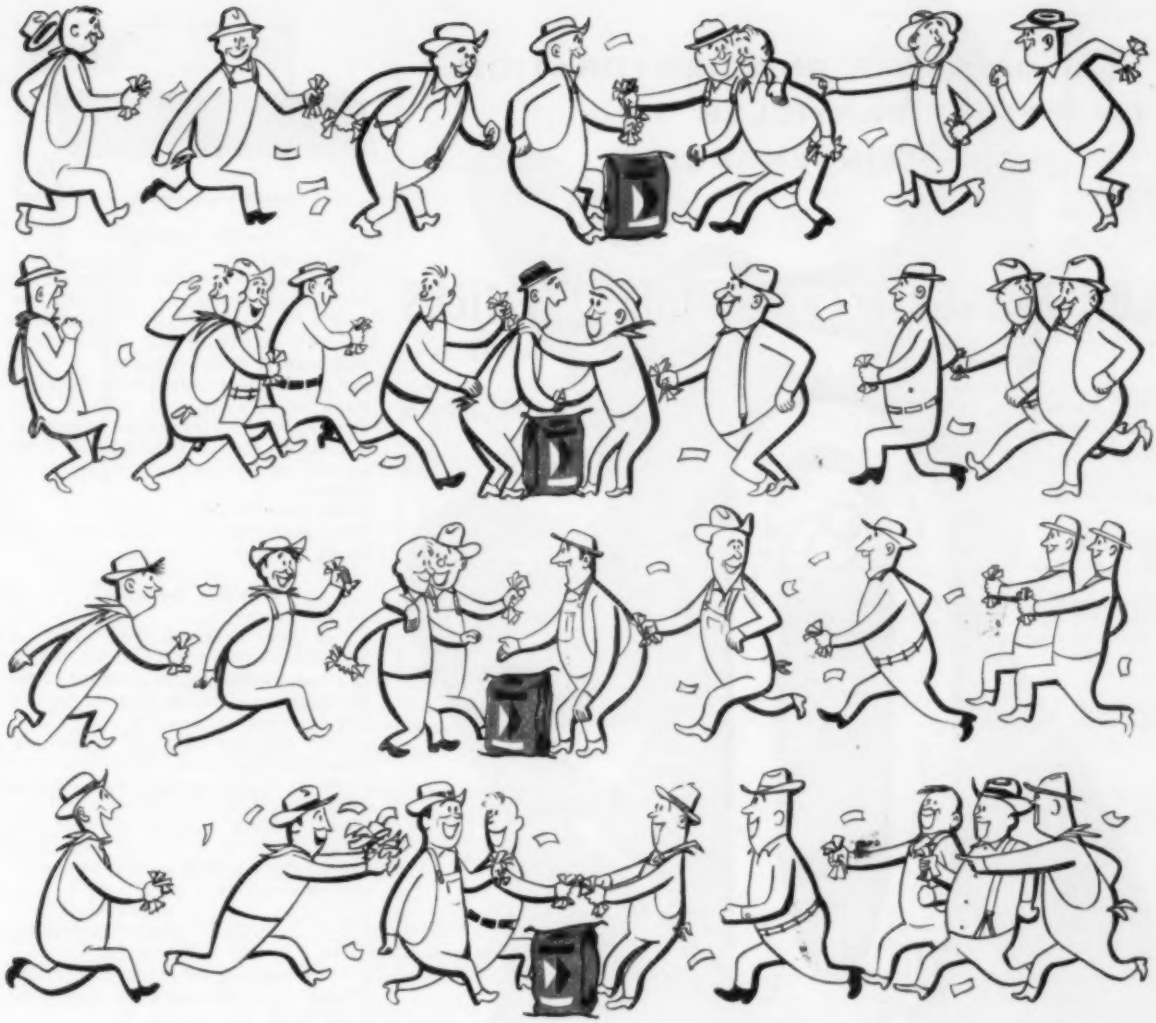
P-6



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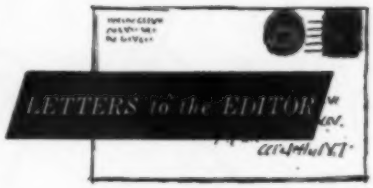


Valuable Publication

To The Editor:

Just a short letter to advise you how much we appreciate and value your fine publication. Our division managers in the field, as well as our administrative staff here at Hayti, Missouri, all agree that *Agricultural Chemicals* is the finest magazine of its type we know of, and certainly holds a tremendous wealth of information for our chemical sales force as well as our agricultural applicator segments.

Frank Dean Kelley
Mid-Continental Aerial Sprayers, Inc.
Hayti, Missouri.

Pesticide Dangers

To The Editor:

In your December, 1960 issue, on page 100, we read under the title "Pesticide Danger Doubted" a summary of the discussion on pesticide dangers, held in San Francisco on November 1st.

We are very interested in receiving a report of this meeting. But, as we don't know the exact address of the American Public Health Association in San Francisco, we allow ourselves to send you herewith our letter to this association and we beg you to be so kind as to complete this address.

B. Henrion
Pechiney Progil,
Paris

The address is: American Public Health Association, 1790 Broadway, New York, New York.—Ed.

Buyers Guide

To The Editor:

Since you publish the leading technical magazine in the field of agricultural chemicals, we thought that you would be able to let us know whether or not there is a buyer's guide on agricultural chemicals available at the present time. We certainly could use one in our Denver area for developing our Agricultural Chemicals Division.

Frank J. Kasik, Jr.
Van Waters & Rogers, Inc.
Denver, Colo.

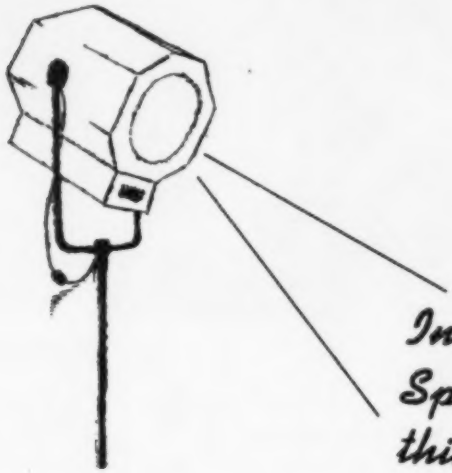
The annual "Agricultural Chemicals" Buyer's Guide will be published this year in our October issue.—Ed.

Copy Found

To The Editor:

We are very grateful for your thoughtfulness and diligence in searching for a copy of the July 1957 issue of *Agricultural Chemicals* for our library. Your promptness in inserting a classified ad for this issue is certainly appreciated.

J. D. Stubbs
Cornell University
Ithaca, N. Y.



In the Spotlight this Month

Fertilizer Demonstrations . . . A study conducted recently in Ohio indicates that farmers can be influenced to use more fertilizers through the use of fertilizer demonstration programs conducted cooperatively by industry, extension, and research workers. Page 14.

11-33-0 Production . . . Experimental plant production of 11-33-0 grade liquid fertilizer from superphosphoric acid and ammonia was started by the Tennessee Valley Authority in 1958. The plant is described and operating techniques and process control are discussed. Page 16.

The Pesticide Outlook . . . A pesticide industry official looks to the future for pesticides and predicts that pesticide use will rise by 20 per cent by the mid-1960's. During the next 20 years, he sees a tenfold increase. Page 19.

Pioneering Liquid Fertilizers . . . The use of field promotions, dealer programs, radio shows, and a complete inventory of application equipment has helped a Minnesota liquid fertilizer manufacturer to introduce liquids throughout its area. Page 23.

Home Garden Marketing . . . Sales personnel in garden supply stores must be prepared to offer acccurate and competent advice to their rapidly growing number of customers. To achieve this end, many dealers and distributors sponsor workshop courses for salesmen. Page 26.

Granular Pesticides . . . The tremendous growth in popularity of granular insecticides and herbicides has brought about a certain degree of confusion. An authority on granules discusses a number of problems which require research and consideration. Page 31.

Fertilizer Consumption . . . A preliminary report on the consumption of commercial fertilizers and primary plant nutrients in the United States for the year ended June 30, 1960. Total consumption was down slightly, but consumption of primary plant nutrients was up. Page 36.

Improved Bagging Operation . . . The factors of moisture and dust were responsible for periodic shut-downs of a Charleston, S. C., fertilizer plant's bagging machine for cleaning. Installation of new equipment and improved conveying systems has kept production levels up. Page 39.

Trade Listing

National Agricultural Chemicals Association, Association Building, 1145 19th St., N.W., Washington, D. C. Lea Hitchner, exec. sec.

National Plant Food Institute, 1700 K St., N.W., Washington, D. C. Paul Truitt, president.

American Potash Institute, 1102 16th St., N.W., Washington 6, D. C. H. B. Mann, president.

American Society of Agronomy, 2702 Monroe St., Madison, Wisc. Dr. Matthias Stelly, exec. sec.

American Phytopathological Society, S. E. A. McCallan, secretary. Boyce Thompson Institute, Yonkers, N. Y.

American Chemical Society, 1155 16th St., N. W., Washington, D. C.

Association of Official Agricultural Chemists, P. O. Box 540, Benjamin Franklin Station, Washington, D. C. William Horwitz, secretary-treasurer.

Agricultural Ammonia Institute, Hotel Claridge, Room 305, Memphis, Tenn. Jack Criswell, executive vice-president.

American Society of Agricultural Engineers, F. B. Lanham, secretary, 505 Pleasant St., St. Joseph, Mo.

Carolinas-Virginia Pesticide Formulators Association, 516 S. Salisbury St., Raleigh, N. C. Hugh Horn, secretary-treasurer.

California Fertilizer Association, Sidney Bierly, executive secretary, Room 213, Ochsner Building, 719 "K" Street, Sacramento, Calif.

Chemical Specialties Manufacturers Association, 50 East 41st St., New York City. Dr. H. W. Hamilton, secretary.

Entomological Society of America, 4603 Calvert Rd., College Park, Md. R. H. Nelson, secretary.

National Fertilizer Solutions Association, 2217 Tribune Tower, Chicago, Ill. M. F. Collie, secretary.

National Cotton Council, P. O. Box 9905, Memphis, Tenn.

Soil Science Society of America, 2702 Monroe St., Madison, Wisc. L. G. Monthey, exec. sec.

Sulphur Institute, 1725 K. St., N.W. Washington 6, D. C. Dr. Russell Coleman, president.

Weed Society of America, W. C. Shaw, secretary, Field Crops Research Branch, Beltsville, Md.

Western Agricultural Chemicals Association. Charles Barnard, executive secretary, 2466 Kenwood Ave., San Jose, Calif.

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He's one of several hundred Cyanamid people who mine, process, research, deliver and service phosphatic materials for your acidulation and mixed fertilizer business. These people put Cyanamid's more than 40 years of phosphate experience into the kinds of products and services you can use.

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Traffic Service: Cyanamid traffic specialists are ready to route and ship your orders without delays. Their knowledge can save you money, and can make your operation run even more efficiently.

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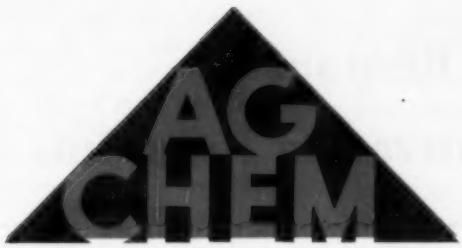

EDITORIALS

WHAT'S ahead in the insecticide market? Expanding sales, coupled with some definite changes in distribution patterns, say two men in prominent positions with leading producers of basic pesticides, who seem to be in an excellent position to know what to expect.

Wayne Yoder, of American Cyanamid, addressing the recent meeting of the Commercial Chemical Development Association, (see page 19 of this issue) makes a long run prediction for the next twenty years of a tenfold increase in pesticide volume. He anticipates that there will be fewer farmers in the future, but that the farms that survive will be larger and more efficiently run, and will make increasing use of all the aids to increased production,—more fertilizer, more pesticides, more cultivation and more care. For the short run—the 1961 season —he predicts heavy demand from the corn and cotton belts for insecticides, as a result of anticipated peak infestations of corn borers and boll weevils this year.

Coupled with a steadily growing use of pesticides by a smaller farm population, Mr. Yoder foresees changes in some of the established distributional patterns. Many farmers, he indicates, are re-examining their traditional purchasing policies, are by-passing the dealer and in some cases the formulator also. They are purchasing technical grades of pesticides and doing their own formulating. Although the overall market for pesticides is expanding, Mr. Yoder sees a declining role for the dealer in that larger market.

J. Paul Ekberg, of Monsanto, speaking before the Western Agricultural Chemicals Association recently (*Agricultural Chemicals*, April issue, pgs. 16-17) also feels that over the next ten years there will be some major changes in established channels of distribution. The basic producer, he feels, will always fill an essential role in the industry, and he sees the formulator's position as also "basically secure." He is by no means as certain about the future share in the industry of the conventional distributor, however, and predicts that he may be largely replaced in the future by a network of "super market" type farm supply stores.

The dealer has always, in our opinion, been the weak link in expanding the pesticide market. The typical busy dealer, enmeshed in the detail involved in handling a stock embracing hundreds of different items, has never had the time to really learn much about pesticides and, with but few exceptions, the basic producers have done very little to help him. If the pesticide industry is ever to approach its true potential, we agree that some major changes in the distribution pattern are an important prerequisite.

* * * * *

ELIMINATION of at least one phase of the preferential tax treatment that has been accorded to farm cooperatives is projected in President Kennedy's recent message to Congress outlining a program for changes in the tax laws. Congress has been asked to revise the present law so that co-op earnings would be immediately taxable in the year in which they are earned, either to patrons, if the earnings are distributed, or to the co-op itself.

There has been a big loophole in our tax laws, which the Kennedy proposal would eliminate, in that earnings allocated to patrons, but not actually paid to them, are taxable neither to the cooperative nor its customers. Commercial

(*Continued on Page* 98)

Ohio State Study Shows

Farmers Are Responsive To Fertilizer Demonstration Programs

Soil testing has been found to be a key step in securing a change in a farmer's use of fertilizer. Attitudes do not seem to affect fertilizer use for farmers who soil test; however there is a strong relationship between attitudes and use for those farmers who do not soil test. Soil testing, therefore, may be one method of "cancelling out" the influence of any negative attitudes toward fertilizer.

The chief anxieties of farmers regarding fertilizer use are; burning their crops, getting proper application, and obtaining the greatest returns from their fertilizer investment. Undoubtedly, more complete information about fertilizer on such topics as fertilizer placement and the elements of plant nutrition could help to neutralize many of these negative attitudes on the part of farmers.

THE effect fertilizer demonstrations have on changing the fertilizer use patterns of farmers is reflected in the 42 per cent increase in fertilizer use achieved in Miami County, Ohio, during 1960 as the result of a demonstration program on corn and meadow crops conducted during 1959 and 1960. The demonstration program was sponsored by the National Plant Food Institute in cooperation with the Ohio Agricultural Extension Service and Ohio State University's agricultural economics and rural sociology department, Columbus, Ohio.

The 42 per cent increase in use of fertilizers in Miami County during 1960 was way ahead of the 3 per cent increase for the state of Ohio as a whole. An 18 per cent rise was achieved in neighboring Champaign County, which had been selected as a check county for the program. The rise in Champaign County is attributed to the effects of the Miami county demonstrations spilling across county lines.

In connection with the fertilizer demonstrations, a survey was conducted to determine the nature of the diffusion process by which a fertilizer practice is communicated from farmer demonstrators to the surrounding farmer audiences. Research interviews were completed with a random sample of 86 commercial farmers in Miami County before the demonstrations of higher fertilizer applications began. Seventy-seven of the original audience sample were reinterveiwed after the demonstration program was completed.

This article is based on preliminary reports of studies conducted by Everett M. Rogers, assistant professor of rural sociology; Gordon Ryder, extension agronomist; and Frank O. Leuthold, assistant professor of rural sociology; all of Ohio State University, Columbus. The complete findings of the studies are to be published later this year by the university.

The major findings of the study are summarized in a preliminary report as follows:

1. Twenty-eight per cent of the audience (farmers not involved in the demonstration) first learned about the demonstration program by seeing a road sign, 22 per cent by talking with a demonstrator (farmer engaged in the program), and 19 per cent by reading about the program in a newspaper.

2. Demonstrators differed from the audience markedly in personal characteristics. Demonstrators were characterized by more opinion leadership, earlier adoption of farm innovations, more favorable attitudes toward fertilizer, more knowledge about fertilizer, more years of formal education, higher formal participation, less belief in agricultural magic, and higher social status.

3. The more effective demonstrators (who talked to more audience farmers) were higher in opinion leadership than the less effective, but did not differ significantly on other characteristics studied.

4. Demonstrators function as opinion leaders in the two-step flow of communication by which ideas flow from mass media to

local opinion leaders and then to the mass audience. Demonstrators use more cosmopolite information sources than the audience. Cosmopolite sources are those external to the community, such as bulletins, farm magazines, soil tests, and contacts with county agents. The Ohio State findings suggest a modification of the two-step flow hypothesis: that ideas flow from any relevant cosmopolite source to opinion leaders and from them by localite means to the mass audience.

5. The portion of the audience that personally communicated with demonstrators was characterized by more opinion leadership, more knowledge of fertilizer, higher social status, more years of education, more favorable attitudes toward fertilizer, earlier adoption of farm innovations, and more formal participation. Farmers reached by demonstrations, as is the case with most other educational methods, seem to need the help least.

6. Members of the audience tended to communicate personally with demonstrators in the same or earlier adopting categories, with a similar or higher social status, and with those who lived within an average of four miles. This is an example of the tendency for individuals to associate with others of similar attitudes and values, although the present findings on this point should be regarded as tentative because of the limited nature of the data.

Effect On Sales

Fertilizer sales figures for 1958-59 and 1959-60, the fertilizer demonstration years, show an increase of 31 per cent in use of nitrogen, 30 per cent for P_2O_5, and 33 per cent increase for K_2O in Miami county, for the fiscal year 1959, over the previous years, 1958-59. The increase in fertilizer use for the state of Ohio for the same period showed a 6 per cent increase in nitrogen, 8 per cent for P_2O_5, and 2 per cent for K_2O. The control county, Champaign County, registered increases of 21 per cent nitrogen, 24 per cent P_2O_5, and 14 per cent K_2O. Although these figures were regarded as surprising when first tabulated, the researchers now credit the amount of increase in Champaign County to its close proximity to the demonstration county. In summarizing the individual data from the various companies selling fertilizer goods in both counties, they found that four companies whose sales representatives were active in the Miami County demonstration program had Champaign as their primary area of operation. The fertilizer tonnage of these four companies increased tremendously in Champaign County for the year 1959-60 over the year 1958-59. In checking personally with the four demonstration surpervisors of these four companies, it was learned that they put into practice some of the things they had learned in Miami County in their sales programs in Champaign County. The tonnage reports of the other 19 companies selling fertilizer goods in Champaign County were almost identical for the two-year period. When the increased sales of these four companies that participated in Miami County demonstrations were deducted from the total increase, consumption in Champaign County was indicated to have increased only about 2 per cent above that for the state average.

Table I. Attitudinal Blocks to Higher Fertilizer Application

Blocks to Higher Applications	Per Cent of Respondents
Costs too much	44%
Think I use enough now	36
Landlord won't let me	7
Manure is better (or) fertilizer burns crops	6
I follow soil tests	4
I'm not equipped	3
Total	100%

Table II. Most Important Fertilizer Information Source

Information Source	Farmer Sample	Demonstrators
Dealers and salesmen	32%	13%
Farm magazines	23	21
County agent or bulletins	15	57
Neighbor and relatives	8	—
Other sources	22	9
Totals	100%	100%

The data gathered on farmers' attitudes toward fertilizer in the before-after studies is not entirely consistent with data secured from the fertilizer industry on actual fertilizer sales (although the two sets of data are not directly comparable). No significant increase in farmers' attitudes toward fertilizer was found as a result of the demonstration program, according to fertilizer sales figures.

Several reasons are suggested for this lack of shift in attitudes: Past sociological studies show that attitudes of any kind are very difficult to change, particularly over a relatively short time period. The change in attitudes might have been more significant if the follow-up study had been made a year after the completion of the demonstration program. In addition, it is possible for fertilizer use to change (as it evidently did) without a major change in attitudes.

The Ohio State scientists found evidence, for example, that soil testing is a key step in securing a change in farmer's use of fertilizer. Attitudes do not seem to affect fertilizer use for farmers who soil test; however, there is a strong relationship between attitudes and use for those farmers who do not soil test. This finding suggests that soil testing may be one method of "cancelling out" the influence of negative attitudes toward fertilizer.

A survey of the major attitudinal blocks to using higher fer-

(*Continued on Page* 96)

Producing 11-33-0 Grade Liquid Fertilizer From Superphosphoric Acid And Ammonia

For best results in the production of liquid fertilizer from superphosphoric acid, a heel of previously prepared liquid first should be charged to the reactor so that vigorous agitation can be established. This helps prevent hydrolysis and overammoniation.

The formulated amounts of ammonia, superphosphoric acid, and water then should be added simultaneously to maintain the desired pH. The water addition should be controlled so that the specific gravity of the liquid is about 1.324 at 180°F. for 11-33-0.

by W. C. Scott and J. A. Wilbanks
Tennessee Valley Authority
Wilson Dam, Alabama

SEVERAL years ago, TVA developed a process for the production of concentrated electric-furnace phosphoric acid containing about 76 per cent phosphorus pentoxide (*3*). This acid is a liquid at room temperature and contains about 70 per cent more phosphorus pentoxide per unit volume than the phosphoric acid in common use. About 50 per cent of the phosphate is in the form of polyphosphates. The use of this acid in pilot-plant studies of the production of liquid fertilizers has been reported (*1, 5*). By ammoniating the acid to a pH of about 6.3, a solution containing about 11 per cent nitrogen and 33 per cent P_2O_5 was obtained. This solution did not crystallize when stored for extended periods at room temperature or at 32° F. In comparison, an 8-24-0 is the highest grade of liquid fertilizer or 1:3 $N:P_2O_5$ ratio that can be produced from ordinary phosphoric acid (54% P_2O_5), and will store satisfactorily under the same conditions. The higher analysis product made with superphosphoric acid results from the presence of polyphosphates, which are more soluble than orthophosphates. The previous work also showed that the superphosphoric acid and the 11-33-0 ammoniated superphosphoric acid can be used to produce high analysis liquid fertilizers containing all three major plant foods

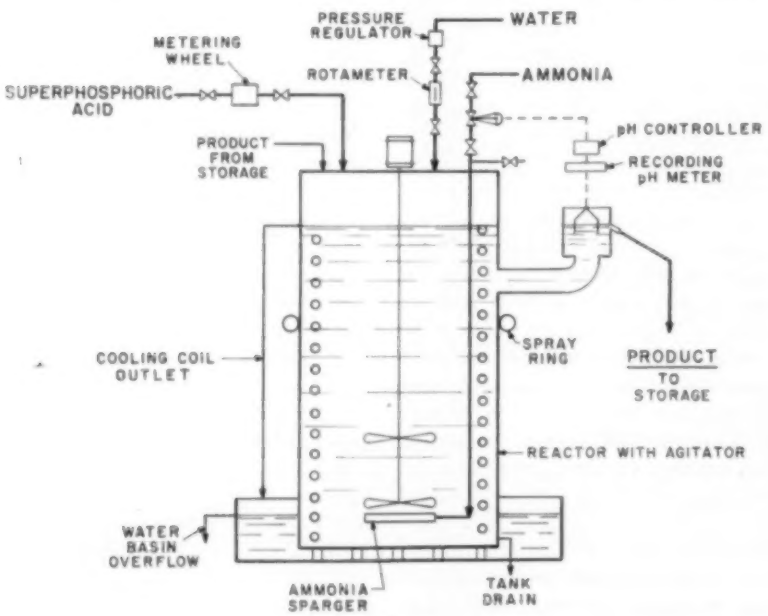

FIGURE 1
UNIT FOR THE PRODUCTION OF 11-33-0 LIQUID FERTILIZER

Presented at the 138th national meeting of the American Chemical Society in New York.

(nitrogen, phosphate, and potash) (*4*). Also, they can be used with impure wet-process phosphoric acid to produce clear liquid fertilizers (*5*). In addition to these advantages, the superphosphoric acid or its ammoniated product (11-33-0) should be of considerable interest to the fertilizer industry because of the savings in storage space and also the savings in shipping and distribution cost.

In order to introduce the high-analysis liquid fertilizer in its test and demonstration program, TVA designed and constructed a production unit of about 2.5 tons per hour capacity at its fertilizer research and development center at Wilson Dam, Alabama.

In addition to supplying 11-33-0 liquid as a base solution in the preparation of various grades of liquid fertilizers for field tests, limited quantities of the base solution and of superphosphoric acid have been made available to liquid fertilizer manufacturers. Consideration is being given to changing the grade of the product from a nominal 11-33-0 to a 10-34-0. The latter grade has better storage properties at low temperatures because of a combination of maximum solubility and good supercooling properties.

Table I. Data on Plant-Scale Production of 11-33-0 Liquid Fertilizer

Test No.	1	2	3
Operating time, hr.	5.5	1.0	3.9
Raw materials feed rate, lb./hr.			
Superphosphoric acid[a]	3525	2420	4360
Ammonia[b]			
(Liquid	—	—	1278
(Gaseous	997	728	—
Dilution water	3150	2352	4012
Average production rate, tons/hr.	3.8	2.8	4.8
Product temperature, °F.	187	195	177
pH	6.2	6.4	6.3
Specific gravity	1.345	1.340	1.342
Chemical analysis, % by weight			
Superphosphoric acid			
Total P_2O_5	77.2	77.1	75.2
Ortho P_2O_5	34.2	38.5	44.2
Ortho P_2O_5, % of total P_2O_5	44.3	49.9	58.7
Product			
Nitrogen	10.7	10.9	10.9
Total P_2O_5	34.7	33.9	34.0
Ortho P_2O_5	16.2	17.0	20.2
Ortho P_2O_5, % of total P_2O_5	46.7	50.2	59.4
Cooling water temperature, °F.			
Inlet	60	84	67
Outlet	157	158	124
Heat removed by cooling water from reaction vessel, Btu/lb. P_2O_5	812	800	603

[a]Superphosphoric acid was fed at average temperatures of 181°, 170°, and 168° F., respectively, in the tests.
[b]Ammonia was fed at about 70° F. in tests 1 and 3 and about 85° F. in test 2.

Description and Operation

The production unit is very simple and is operated continuously. It consists of a flat-bottom tank (reactor), 38 inches in diameter and 72 inches high, which is equipped with an agitator and an internal cooling coil. The agitator consists of two 12-inch-diameter arrowhead turbine blades mounted on a common shaft, which is driven at about 200 revolutions per minute with a 3-horsepower motor. The cooling coil consists of approximately 187 linear feet of 1½-inch pipe arranged as a helical coil of twenty-two turns having a diameter of 32 inches (center to center). In addition to removing heat from the reactor by pumping water through the coil, some heat is removed by spraying water on the shell of the reactor. The reactor has an effective volume of about 230 gallons.

Although the reactor shell and agitator shaft and blades were fabricated from stainless steel, mild steel would have been suitable, as shown in laboratory tests and in tests of specimens in plant reactors. The stainless steel equipment was used because it was already on hand. Although the internal coil, which was fabricated from black iron pipe, failed and had to be replaced after about 2 years, the failure was caused by wear from vibration against the coil spacers rather than from corrosion.

In laboratory corrosion tests of mild steel specimens submerged in aerated 11-33-0 liquid (pH, 6.2) at a temperature of 180° F., the corrosion rate was 7 mils per year. The corrosion rate of mild steel specimens also was tested in a reaction vessel of a typical commercial liquid fertilizer plant in which superphosphoric acid was used to produce several grades of liquid fertilizers including several grades containing potash; the corrosion rate was about 12 mils per year.

The only stainless steel actually required in this plant is the acid-handling equipment. Figure 1 is a simplified flowsheet of the plant.

At the beginning of a run, a heel of 11-33-0 grade liquid is put in the reactor so that the incoming materials will be in the effective area of the agitators; this helps prevent hydrolysis and localized overammoniation, which would result in the formation of diammonium phosphate crystals. The super-

The authors wish to acknowledge the assistance of many members of the technical and operating staff of the Office of Agricultural and Chemical Development.

phosphoric acid, anhydrous gaseous or liquid ammonia, and water are fed continuously and simultaneously to the reactor, and the product flows continuously from the reactor through an outlet near the top of the surge tank from which it is pumped intermittently to storage. The superphosphoric acid is heated to 125° to 185° F. to lower its viscosity and thereby facilitate pumping and metering. It is metered by means of a metering wheel and flows into the top of the reactor. The flow of ammonia is regulated automatically with a recording pH controller. The ammonia is released through a sparger located about 6 inches above the bottom of the reactor. Water is metered with a rotameter and flows into the top of the reactor on the side opposite the superphosphoric acid. The water must be kept away from the acid until after ammoniation to avoid hydrolysis of some of the polyphosphates to orthophosphates.

The concentration of the product is determined by measuring its specific gravity and is adjusted by changing the amount of water added. The specific gravity of the product is about 1.342 at 180° F. or about 1.365 at 75° F. Usually about 5 per cent in excess of the formulated amount of water is required to compensate for vapor losses. The temperature of the liquid in the reactor is controlled in the range of about 180° to 195° F. by adjusting the flow of water through the cooling coil.

The proportions of acid and ammonia are fixed so as to maintain an approximately neutral solution (pH, 6.0 to 6.3). At a pH above 6.3 the product is likely to salt out in cool weather. The following tabulation shows the lowest temperatures at which solutions of different pH's and containing about 48 per cent of the total P_2O_5 in the polyphosphate form were stored for long periods without salting out.

Per cent by weight			$N:P_2O_5$ weight ratio	Minimum safe storage temperature, °F.
pH	N	P_2O_5		
6.0	10.0	33.6	0.297	0
6.1	10.2	33.3	0.306	0
6.2	10.5	33.4	0.314	0
6.3	10.7	33.2	0.322	0
6.4	10.9	33.1	0.329	60
6.5	10.9	33.2	0.328	60
6.6	11.1	33.0	0.336	85
6.7	11.2	32.9	0.340	85
6.8	11.3	33.3	0.341	90
6.9	11.6	33.4	0.347	100
7.0	11.9	33.2	0.358	110

Gaseous vs. Liquid NH_3

During the first 2 years of operation, the superphosphoric acid was neutralized with gaseous ammonia because it was already available at the plant site and the capacity to produce liquid fertilizer was not an important consideration. No difficulties were encountered. The production rate was limited by the cooling capacity and ranged from about 2.5 tons per hour with cooling water at 85° F. to about 4 tons per hour with cooling water at 60° F. However, by neutralizing the acid with anhydrous liquid ammonia, which has a cooling effect when it vaporizes, the production rate later was increased by a factor of 1.3. When anhydrous liquid ammonia was used, it was necessary to remove about 600 Btu per pound of P_2O_5 with cooling water to maintain a temperature of 180° to 195° F. whereas, with gaseous ammonia, it was necessary to remove 800 Btu. Calculations indicate that an additional increase in capacity of about the same magnitude could be obtained by using aqua ammonia for neutralization; the heat to be removed with cooling water would be about 450 Btu per pound of P_2O_5. The form of ammonia used for neutralization of the acid had no effect on the quality of the product as long as agitation during neutralization was sufficient to prevent localized overammoniation. In a few instances when overammoniation occurred, some diammonium phosphate crystallized in the reactor. The crystals dissolved readily, however, when feeding of the reactants was discontinued and the product was allowed to stand for a few minutes. Results of typical plant tests in which anhydrous gaseous and liquid ammonia were used for neutralization of the acid are shown in Table I.

Hydrolysis of Polyphosphate

Earlier work (*4*) showed that little hydrolysis of the polyphosphates in superphosphoric acid occurred during the production of liquid fertilizers if the acid was not mixed with water before ammoniation. The data in Table I shows that, at operating temperatures of about 180° to 195° F., hydrolysis of polyphosphates amounted to only 0.3 to 2.4 percentage points, which is not considered significant.

The 11-33-0 grade liquid will hydrolyze slowly during storage. The degree depends on the temperature and length of storage. In laboratory tests, no appreciable hydrolysis occurred in 4 months at 32° F. About 5 per cent of the polyphosphate hydrolyzed in 4 months at 80° F., about 13 per cent hydrolyzed in 2 weeks at 120° F., and about 70 per cent hydrolyzed in 2 weeks at 150° F. These data indicate that hot weather storage for prolonged periods should be avoided. Liquid that has been stored during the summer should not be continued in storage through the winter. With the decrease in polyphosphate content

(*Continued on Page 93*)

Agronomically, the P_2O_5 in liquid fertilizers made from superphosphoric acid is at least as effective as that in concentrated superphosphate and other water-soluble liquid fertilizers.

The Pesticide Outlook

Counts of overwintering insects are among the many important factors affecting pesticide manufacturers in planning production schedules. Reports from federal and state entomologists this year, for instance, indicate that there will be large corn borer and boll weevil infestations this season and this means that there will be a good market for insecticides in the corn and cotton belts.

by Wayne Yoder

Pesticide Products Manager
American Cyanamid Company

THE pesticide business is an important segment of the chemical industry. In 1960, at the basic manufacturer's level, the business amounted to 290 million dollars. It involved fifty basic manufacturers and about five hundred formulators operating regionally and nationally. Although in most cases pesticides produced by the formulators are marketed through distributors to the ultimate consumers, this practice shows definite signs of changing. In some areas, the insecticide formulator is selling direct to the consumer.

There are at least eight outside factors that affect the pesticide business and which have a bearing on sales and production. Weather affects the outlook in many ways. Besides its direct effect on crops, it affects the enemies of the crops—the insects, the diseases, and the weeds. A warm dry season will produce a heavy attack of insects, much less infection by diseases, and a light crop of weeds. A cool wet season, however, will have opposite results. This was the case in 1960 when overall insecticide sales dropped, compared with sales of fungicides and herbicides. Herbicide sales in 1960 jumped seven per cent over 1959.

Counts of overwintering insects are extremely important to pesticide manufacturers in planning production schedules. Reports from federal and state entomologists this year, for instance, indicate that there will be large corn borer and boll weevil infestations this season and this means that there will be a good market for insecticides in the corn and cotton belts.

Despite the general concern about the farm income problem, most farmers seem to be making money. Greatly increased incomes in 1960 over 1959 have been reported from such states as New Jersey, Iowa, Maine, and Massachusetts. In addition, the Department of Agriculture estimates that 1961 income will run 5 or 6 per cent higher than 1960.

Another favorable sign facing the pesticide industry is the prediction that there will be 80 million more people in the United States by 1980. This means that there will be more people eating and wearing clothes. Also, the nonfarm market for pesticides can be expected to grow accordingly. It already has been credited with 15 per cent of all the dollars spent on pesticides in the United States.

During the next 20 years, the pesticide business will increase tenfold, because only by increasing its use of pesticides can agriculture continue to increase its productive capacity to meet the demands and needs of consumers in an expanding population.

From a talk presented before the Commercial Chemical Development Association, March 16, in New York.

In spite of the general population increase, the farm population today is down to what it was during the Civil War. This is a sign of efficiency on the farm—and pesticides are an important part of that efficiency. Despite the constant drift of the farm population away from the farm, the pesticide industry is not losing its market. This is because the good, successful farmers are not leaving the farm. The farmer who decides to give up generally is not operating a successful or efficient farm. Usually, however, he sells his farm to his successful neighbor who adds it to what he has and expands his operation.

This is the trend all over. The pesticide industry is selling more pesticides to fewer farmers who

(Continued on Page 90)

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Part II of Special Report

Nitrogen Industry-Water Transport Reviewed At National ACS Meeting

Increased opportunity for moving fertilizers by water is seen in shipment of phosphate materials from Florida to mid-western farm belt.

"THE most promising opportunity for increased water movement of fertilizers lies in the shipment of phosphate materials from Florida to the midwestern farm belt," Odin Wilhelmy Jr. told the 139th meeting of the American Chemical Society at St. Louis, March 21-31, in reviewing a study conducted in 1959 by Battelle Memorial Institute for the Mississippi Valley Barge Line Company. He said that information gathered in personal interviews with 28 fertilizer manufacturers throughout the eastern half of the United States revealed that virtually no domestically-produced potash or mixed fertilizers are likely to move by water to domestic consumers in the foreseeable future. Among nitrogen fertilizers, limited shipments of urea and non-pressure nitrogen solutions appear to be the only likely prospects for inland waterway movements, Mr. Wilhelmy said.

There is an additional opportunity for water shipment of phosphates, other than rock and triple superphosphate, that should not be ignored. This is the movement of ammophos materials from Florida, Texas, or Mississippi, plants to midwestern markets. At the moment, production and use of ammonium phosphates in areas amenable to water shipments is relatively small, but the volume is increasing, he pointed out.

In connection with phosphate rock and its derivatives, Mr. Wilhelmy said that a significant tonnage is shipped from Florida to major consuming areas. The proportion of these materials that is being moved, or could be moved, by water to the four central census regions (East and West North Central, and East and West South Central) is substantial. Florida, now producing over 70 per cent of domestic phosphate rock, is and will remain the principal source of fertilizer phosphorus in the United States in the foreseeable future.

The four central census regions combined are by far the largest market for these Florida-produced phosphates and are likely to remain so in the years ahead. At present, these regions consume over 60% of the fertilizer phosphorus used in the U.S. Among phosphate materials applied directly to the soil, these regions account for more than 95 per cent of the ground rock, half of the normal superphosphate, 2/3 of the triple superphosphate, and 60% of other phosphate fertilizers. In the same area are concentrated a major share of the nation's superphosphate plants, as well as hundreds of plants making mixed fertilizers that contain a phosphate material as a prime ingredient.

Mr. Wilhelmy said that the removal of certain obstacles and the adoption of certain practices would contribute toward more effective use of water transport. He recommended the following:

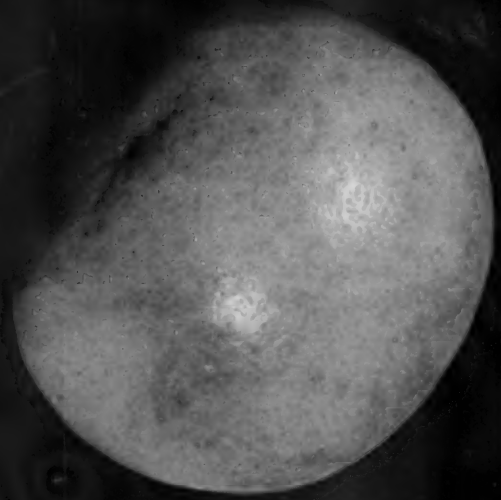
1) Development of an economic procedure and facilities for moving ground phosphate rock by water.
2) Alternatively, establishment of grinding facilities for phosphate rock at selected points in market areas.
3) Establishment of terminal storage facilities at selected points in market areas.
4) Development of better and more economic handling and loading materials for fertilizer grade ingredients.
5) Establishment of more joint barge-truck or barge-rail arrangements to facilitate shipments to plants not located on navigable waterways.

Mr. Wilhelmy observed that far-sighted companies already are giving considerable attention to these problems. Their ultimate solution will require still further advances in both the technology and economics of fertilizer transportation and distribution.

Competition has continued to increase in the nitrogen industry over the past fifteen years in the face of earlier predictions that the postwar period would see just the reverse occur.

IN discussing the modern structure of the nitrogen industry, and growth of competition in this industry, A. E. Abrahams, Oregon State College, pointed out that a major change has occurred during the period 1940 through 1958. Where once eight firms had constituted the industry, now 39 firms

(*Continued on Page* 89)



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Crookston Liquid Fertilizer, Inc.

Field Promotions, Dealer Program Help Introduce Liquid Fertilizer

An indication of the acceptance of liquid fertilizers by farmers in the Crookston, Minn., area can be found in the sales figures of the manufacturer's 14 dealer outlets. One dealer, for example, reports that his liquid sales have increased in two years from ten per cent to 50 per cent of his total fertilizer sales.

THE northernmost liquid fertilizer plant in the United States was built in 1958 in Crookston, Minnesota, at a time when liquids were unknown in that area, one of the state's best markets for fertilizers. Crookston, the county seat of Polk County, is in the heart of Minnesota's Red River Valley, where the deep, black prairie soils are ideal for beets, potatoes, and wheat. The more than 30,000 tons of fertilizers used in Polk County last year represents about 8 per cent of the state's total.

In 1957, however, farmers in that part of the country were unfamiliar with complete liquid plant foods, and dry fertilizers were used almost exclusively. Crookston Liquid Fertilizer, Inc., was formed by Thomas O. Cochrane, a former salesman for dry fertilizers, and William Strickler, a local farmer. Much of the capital was provided by local farmers.

The bulk of the liquid fertilizer used in the area goes on small grains. Crookston Liquid Fertilizer maintains a complete inventory of application equipment for farmers and dealers, including storage tanks. Much of the company's fertilizer production is applied on a custom basis by an independent contractor with whom the company has a working arrangement. The applicator, Vernon Hawkins, operates two trucks. Last year he covered some 17,000 acres, at an average of 20 acres per hour. He charges 60 cents per acre.

Formulas shown on the company's current price list include 9-9-9, 6-18-6, 8-16-8, 8-24-0, 10-20-0, 15-15-0, 12-12-6, 18-9-0, and 0-54-0. Among the largest sellers are 15-15-0 and 18-9-0. Quite a good business is done with the direct application of 0-54-0 and a straight nitrogen solution for fall plow down also is very popular. Speaking of this, Mr. Cochrane says, "Uran has been a real door opener for selling our complete solutions. Application is quite easy and results are very obvious." He adds that field and promotion efforts by his chemical supplier have been extremely helpful.

"We are dealing with progressive farmers who are willing to be shown," Mr. Cochrane comments. "They follow our test plot work, university studies, and so on, and also are keenly interested in the results obtained by their fellow farmers. Part of our sales job, of course, is to see that this information gets around. Right now, most of our customers are putting on 30 to 40 pounds of nitrogen at plow-down, then following along with the necessary formula at seeding time. We are using the results of both experimental and practical work to show them the advantages

of putting more nitrogen in their starter fertilizers, and our steady growth indicates that this is the right way to sell."

The equipment installed by Crookston Liquid Fertilizer incudes a B&L Autobatch, a liqualizer, and a converter – all package components designed to be operated separately or together. They were supplied by Barnard & Leas Manufacturing Co., Cedar Rapids, Iowa, a firm with long experience in the agricultural field.

Mr. Cochrane reports that his company is highly satisfied with this type of equipment, which combines meter controls and automation with a highly effective combination of jet and pump agitation. The system, he says, makes possible instantaneous neutralization of acid and ammonia (thus preventing corrosion and vapor loss), and provides thorough and accurate blending. In operation, formulas are pre-set on the Autobatch panel and a single starter button is pushed.

The B&L Convertor employed at Crookston serves a dual purpose. It is used for changing anhydrous to aqua ammonia under controlled conditions, and it also is used as a cooler to speed capacity when high analysis formulas are made in the mixing operation.

Capacity for complete analysis fertilizers is from 15 to 20 tons per hour, depending upon formulation. Since the bulk of the liquid is produced and applied in a relatively short period of time (six weeks to two months), ample hourly capacity is important. Work days are long when the season is at its peak, and the Crookston equipment works almost around the clock during this period.

Operation on a high-capacity basis for two months easily would produce 10,000 tons of finished product, Mr. Cochrane states. Tonnage requirements have not reached that level yet, but they are doubling each year. Mr. Cochrane looks to the future with optimism pointing out that none of his customers has removed a liquid attachment from his equipment.

Thomas O. Cochrane (left), manager of the company, keeps the story of liquid fertilizers before the farmer with a daily program over Crookston's radio station.

Actual operation of the Barnard & Leas equipment in the plant is under the direction of Leo Lippert (right), plant manager. The company also maintains application equipment.

At the beginning, Crookston Liquid Fertilizers got off to a sound start by setting up a chain of dealers. Today, there are 14 dealer outlets made up of firms established in the farm supply business, such as grain elevators and dry fertilizer dealers. Each dealer has storage capacity for from 17,000 to 50,000 gallons of Fert-I-Flow (the company's trade name) and through this dealer organization, Crookston has developed markets within a 150-mile radius of its plant. An indication of the acceptance of liquid fertilizers in this area can be found in the sales figures of these dealers. In two years, for example, one dealer reports that his liquid sales have increased from 10 to 50 per cent of his total fertilizer sales.

Officials of the Crookston company feel that starting out with a strong dealer program was an essential factor in the rapid development of the business. They anticipate continued expansion of sales through dealers, but, at the same time, feel that an even greater growth may come in their own local market. Tonnage today is divided, with 60 per cent being sold through dealers and 40 per cent being sold locally. "With tonage constantly going up," Mr. Cochrane comments, "we expect that this ratio will change so that perhaps 70 per cent of our output will be distributed locally. We realize that our local market, tied in with the service we can offer, is our best insurance for holding the lead in the liquid fertilizer business in our part of the country.

"We will continue to expand in every way, but much of the emphasis in our thinking is on how we can provide the finest in fertilizer know-how and facilities to farmers right in our own county," Mr. Cochrane feels.

Mr. Cochrane's principal interest is in management, (Mr. Strickler is president of the company) and in the development of business not only through direct selling, but also through dealer and farmer meetings that often are conducted in co-operation with his suppliers' salesmen. Actual operation of the equipment in the plant is under the direction of Leo Lippert, plant manager. Mr. Lippert's background includes service engineering work with a farm implement manufacturer.

Among the company's activities in getting the liquid fertilizer story before the farmer is the sponsorship of a daily morning radio

(*Continued on Page* 93)

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Home Garden Marketing Requires Qualified Dealers

It is nothing more than standard selling practice that a garden supply salesman should endeavor to send his customer away with a complete supply of fertilizers, pesticides, and tools in addition to the grass seed that originally brought the customer into the store. Sales personnel, however, have an obligation to their employer and to their customers to provide sound advice and accurate answers to customers' questions about agricultural chemicals.

THE unprecedented increase in the number of home owners in the United States since the end of World War II has brought with it a corresponding increase in the garden supply business. What had been small roadside lathe houses dealing with occasional visitors, now must be super markets to gardeners, offering everything from seeds to tools.

In addition to merchandise, and, perhaps, equally important, garden supply stores must be prepared to offer accurate and competent advice to customers, many of whom are visiting the store with nothing more definite in mind than the purchase of a package of grass seed. It is nothing more than standard selling practice that the salesman should endeavor to send the customer away with a complete supply of fertilizers, pesticides, and tools, as well as the grass seed. In the words of sales instructors, sales personnel must "upgrade their selling techniques by gaining the attention of the customer, arousing his interest, and creating a desire." If this is to be done effectively, however, and if the customer is expected to return for future purchases, sales personnel have an obligation to their employer and to the customer to provide sound advice and accurate answers to customers' questions.

With this in mind, it has become a practice of many distributors of garden supplies to sponsor workshop courses for garden supply salesmen from department stores, garden centers, nurseries, and seed and hardware stores. In one such course, conducted by the Richmond Power Equipment Co., Richmond, Va. distributor of garden supplies and equipment, salesmen are put to work pruning roses, sowing grass seed, spraying shrubs, and tending lawns, in plots illuminated by floodlights. The class meets one night a month throughout the year, except in December, taking up problems the home gardener will encounter in coming months. The theory behind such training schemes, of course, is that, if a garden fails, the gardener becomes discouraged and buys no more garden supplies.

Other important factors to be considered by retail dealers are those associated with standard good-merchandising practices. These would include a carefully-selected store location, effective arrangement of shelves and other interior displays, utilization of displays that fit the season and tie in with advertising, planned and considered advertising, and a good product line. In carrying out these steps, garden supply dealers are tending more and more to depend upon their suppliers for assistance. In offering this assistance, in the form of such promotional efforts as tie-in advertising, display racks, and clerk training, many large chemical concerns that manufacture basic agricultural chemicals are becoming closely associated with garden chemicals in the minds of consumers.

This, among other considerations, has led to a shift in sales emphasis by many large companies who now offer their own trademarked products through retail outlets. One such concern is the Dow Chemical Co., Midland, Mich., which now markets its line of 70 agricultural pesticides through approximately 10,000 dealers. Dow's efforts to aid its dealer group to sell more of the Dow pesticides have been built around a program of cooperative advertising in local newspapers, paid for by Dow, carrying the name of the dealer and timed by him for maximum influence on his local market. The program is reported to have helped materially in increasing sales of Dow agricultural pesticides from $30 million to $45 million annually between 1955 and 1959. Before 1950, Dow sold most of its agricultural percentage through formulators to chemicals in bulk, a substantial be marketed under private brands.

Another large company that is devoting more and more of its attention to its home garden line is the Ortho Division of California Chemical Co., formerly California Spray-Chemical Corp. The market for the Ortho line is made up of the 25 million single family, owner-occupied homes throughout the United States. Sales primarily are through self-selection and clerk-manned outlets at garden shops, supermarkets, nurseries, and hardware establishments.

Geographical variations require differences in chemical formulations for many items. For the east there are 50 products in the Ortho line; for the west, 55. Some products, such as Ortho lawn and garden food, are sold only in the west.

Although headquartered in Richmond, Calif., Ortho maintains additional plants for packaging home garden products at St. Louis, South Plainfield, N. J., and Orlando, Fla. The seasonal nature of the agricultural chemicals business works to an advantage in relation to small package filling. Year around sales would require many more packaging lines than Ortho now employs. Ortho begins the packaging of next year's products in August and undertakes its active distribution campaign to dealers in September. By evaluating past sales figures and future projections, an effort is made not to produce an over-supply of a particular product. With the long packaging cycle which the seasonal lull permits, most low-volume products can be prepared early, leaving the packaging equipment free during the peak sales months to take care of un-anticipated demand for the faster-selling items, such as the rose dust puffer which averages a million a year.

Ortho officials have given considerable attention to integrating the over-all product line to achieve a strong family design resemblance. Similar study has been devoted to displays. Many of the corrugated shipping containers are colorfully printed on the inside as well as on the outside. After the case is opened, the flaps can be folded down to form an attractive counter merchandising unit.

The tie-in of household items with household names, such as Louis Nye, popular television comedian, plays a large part in arousing and maintaining the interest of home gardeners. It must be properly timed and planned, however, to be successful. In addition, it must be consistent. One-shot ads do not result in a long-range profit.

Ortho feels that a successful marketing program for small package agricultural chemicals demands—in addition to a good line of products—a complete line, so that the dealer will not need to order from a series of companies and yet can offer a "one-stop" service where his customers can buy all the agricultural chemicals products they require. Another practice followed by Ortho is the placing of a limit on the number of distributors of Ortho products. If there are too many distributors, it is felt that the franchises will have lowered value. It is better practice, they feel, to line up a select group of distributors who will actively push a line on which they and their dealers can make sales—and profits.

The fourth point in Ortho's successful marketing program is aid to the distributor's customer—the dealer. This is accomplished by training salesmen in how to sell the end user; by providing effective literature on end use; by demonstrations of effective use; by programs before such groups as garden clubs; and by *effective* dealer aids and point-of-sale material.

Specific recommendations offered by Ortho to garden supply dealers are summed up in an article by Channing E. Jones Jr., Ortho merchandising manager, that appeared in *Modern Garden Center* magazine. Mr. Jones urges dealers to arrange merchandise to achieve eye and sales appeal; to keep shelves and aisles uncluttered; to utilize all available space in a manner that will bring returns; to keep the store interior colorful and, at the same time, expressive of cleanliness; and to use timely, mass displays for seasonal needs.

The use of mass displays is important when one considers the possibilities of developing impulse sales through the massing of related objects. According to Mr. Jones, mass displays, plus interest, add up to produce quick and profitable turnover of home garden merchandising.

The interest factor in the equation outlined by Mr. James often is the responsibility of the salesman. Harry Gross of the Northwest Feed and Insecticide Company in Spokane, Wash., is of the opinion that his $400,000 annual garden business would drop by 25 per cent if his sales people stopped asking questions and supplying honest information in response to customer's questions. Advertising plays an equal part in arousing and maintaining the interest of home gardeners. Effective advertising by garden supply dealers, however, must be properly timed and planned, to be successful. In addition, it must be consistent. One-shot ads do not result in a long-range profit. Advertising departments of large concerns can be

(*Continued on Page* 89)

GRANULAR PESTICIDES

Demand for and commercial use of granular pesticide formulations have forged ahead of investigational work on equipment characteristics and product specifications required to fulfill most advantageously the demands of an insect control program. Standards are often set without full consideration of all factors involved.

Successful end results require full recognition of the interrelationship of inert carrier, specific pesticidal chemical, solvents and other additives, method of processing, and method and equipment used to distribute the finished product in the field. Best results demand consideration of the overall program.

by Kenneth Krausche
Floridin Company
Tallahassee, Florida

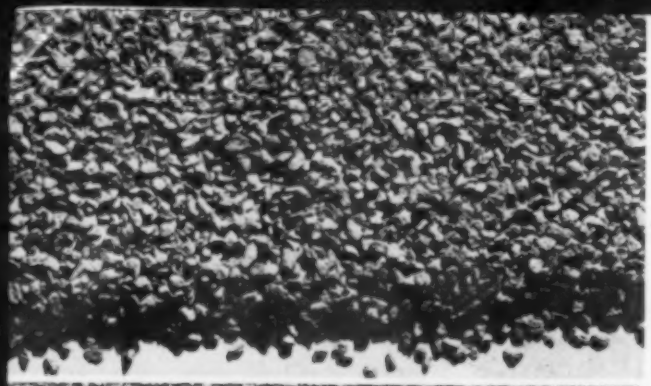
SINCE the publication of a previous article[1] two years ago, the production and application of granular insecticides and herbicides have expanded with considerable rapidity. Although the program has been eminently successful, this tremendous growth has brought with it a certain degree of confusion. There are a number of problems which require serious research and thoughtful consideration, if continued development and optimum beneficial results in this field are to be realized to the full potential.

Demand and commercial use of finished granular pesticide formulations have forged ahead of investigational work on equipment characteristics and product specifications required to fulfill most advantageously the demands of the control program. Individual manufacturers, and some state groups, tend to set arbitrary standards without full consideration of all the factors involved. Successful end results require full recognition of the inter-relationship of inert carrier, specific pesticidal chemical, solvents and other additives, method of processing, and method and equipment used to distribute the finished product in the field. For example, there would be little benefit in the application of an ideal finished product by applicating equipment incapable of a fairly uniform distribution and accurate calibration, nor would a well-engineered machine be capable of good distribution of a non-uniform product, with a very wide range of particle sizes from lumps down to a high dust or fines content. Similarly, a high quality inert granular carrier used as a starting raw material could be ruined by attrition during improper processing. Best results demand consideration of the overall program and compatibility of all its parts – carrier, pesticide, additives, processing, and application.

One source of confusion is the great variety of particle size ranges demanded by this market. Limiting this discussion for the moment to the widely used absorptive carriers, there is an almost infinite variety of types and sizes theoretically possible. In the earlier article, the RVM and LVM types were described and mesh size designations were defined. Some of the mesh ranges in demand today include 15/30, 16/30, 18/35, 20/35, 20/40, 24/48 and 30/60. There may be others. Although one mesh range of finished product could not possibly be optimum for all end uses, it appears likely that a number of over-lapping size fractions could be eliminated for the sake of practical aspects of production, availability, and economy.

One inconsistency in mesh size designation is the simultaneous use of two different systems: U. S. Standard Sieve Series and Tyler Standard Screen Scale. U. S. Standard Number 20 is identical with Tyler 20, but U. S. Standard Number 40 is equivalent to Tyler 35. Obviously, a granular carrier of 20/40 mesh range on the U. S. Standard scale is equivalent to a 20/35 on the Tyler scale. Number 24 appears only on the Tyler scale, Number 30 only on the U. S. Standard scale; Number 16 appears on both scales but designates different size openings, while Number

[1] *Granular Pesticides*, Agricultural Chemicals, April, 1959, pages 30-32.



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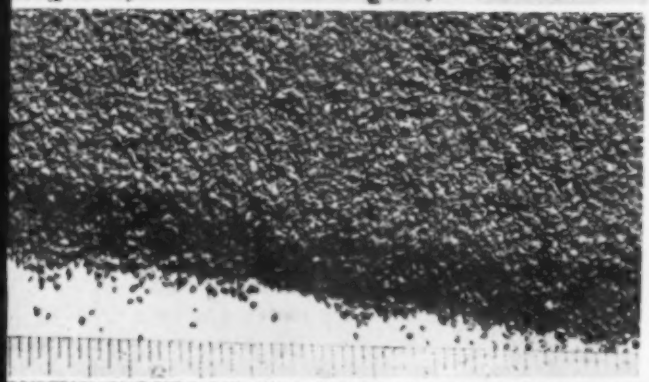

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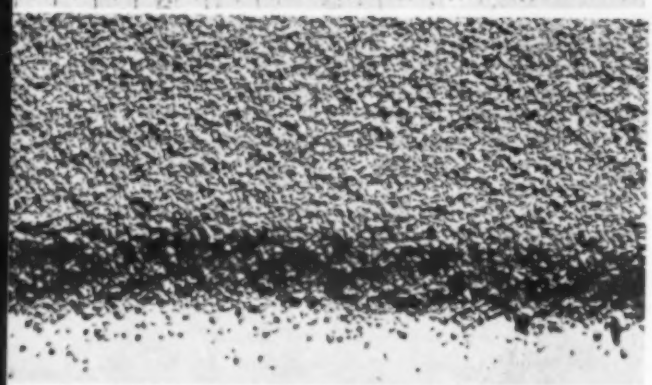

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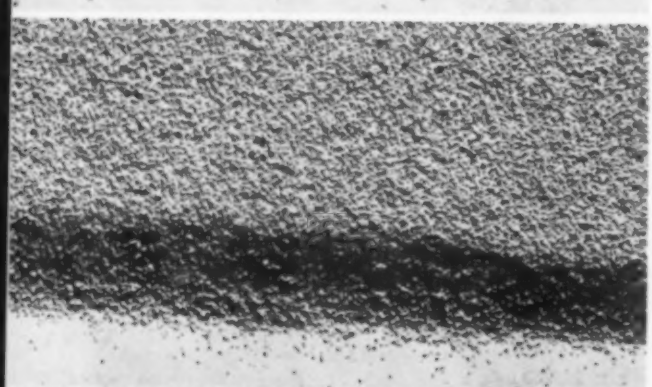

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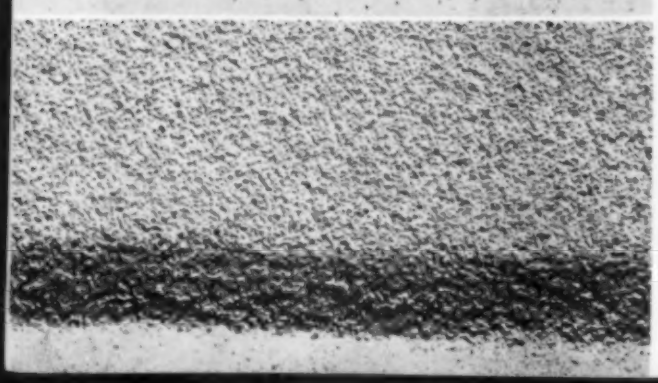


30/60

60 also appears on both and, in this case, indicates exactly the same size openings. This possible source of misunderstanding could be cleared up easily by adoption of one standard scale.

Somewhat more controversial is the determination of practical limits on permissible amounts of fine material. The formulator may assume that a 20/40 mesh carrier contains 0% coarser than 20 mesh and 0% finer than 40 mesh. Some of the carriers can be produced with only a small fraction of 1% fine material. But, to clean up these products beyond practical commercial limits would be slow, laborious, and expensive. Even then, the mere packaging, shipping, unloading, etc. would produce some degree of attrition, resulting in some measurable amount of "dust." In general, the closer cut carriers, with a minimum of fines, are more expensive than the products covering a broader mesh range and containing slightly more material passing the screen which nominally defines the fine end of the product. These practical aspects should be recognized in the industry and reasonable tolerances, especially on the fine end, allowed. On the other hand, too high a content of fines or dust interferes with uniform distribution, increases drift, and may defeat the basic purposes of the granular pesticide program. Significantly, some formulations of oily, waxy, or sticky technical pesticides, carefully processed, contain a smaller amount of dust than the starting carrier used as the sorptive base. As the pesticide is impregnated onto the carrier, the free dust adheres to the surface of the granular particles. The use of a scalper screen is another way of cleaning up a granular carrier or the finished granular pesticide.

Unfortunately, the highly competitive market, marginal profits, and buying habits of the consumer so often characteristic of the agricultural chemicals industry are not always conducive to adequate consideration of quality.

In running sieve analyses, the sampling procedure and precision of the method itself are important factors. In any package of granules, some segregation in regard to particle size tends to take place when the package is handled or moved. A random grab-sample may contain a relatively high proportion of fines. A complete and intact bag-full, usually 50 pounds net, should be run through a sample-divider to derive a representative sample for screen analysis. Concerning reproducibility of the method itself, limited study has indicated a need for more complete standardization of the method of screen analysis in order to improve accuracy. One limiting factor, often not recognized, is that the standard testing sieves, themselves, may deviate significantly from the mathematical designation. For example, even with precision wire screen sieves, the permissible variation in average opening for screens between U. S. 18 and U. S. 70 is ± 5%. That would allow approximately a ± 10% variation in the area of the average opening. The maximum opening in a given screen may exceed the nominal designation by as much as 15% in the U. S. 18 to 35 screens and as much as 25% in U. S. 35 to 70 screens.

In setting mesh specifications on granular carriers, and on finished granular pesticides, therefore, those concerned must be cognizant of these inherent deviations and recognize the necessity of practical tolerances in their demands.

Before leaving the discussion of screen analysis and mesh designation, it should be mentioned that mesh range limits alone are not enough to completely define particle size. Obviously for a given granular carrier, smaller particle size will result in more particles per pound. But it is possible for two true 20/40 mesh lots of the same mineralogical material to vary significantly in number of particles per pound because of different distribution within the mesh range as shown by the following.

Suppose two 20/40 mesh absorptive carriers, A and B, have a distribution of particle size within the 20/40 range as follows:

	A	B
20/25	10%	20%
25/30	30	40
30/35	40	30
35/40	20	10

In round figures, the particles per pound of carrier in these narrow ranges would be close to the following:

20/25	1,125,000
25/30	1,900,000
30/35	3,250,000
35/40	5,400,000

Calculations based on the foregoing figures show that Product A would have approximately 3,062,500 particles per pound while B would have approximately 2,500,000—yet both are true 20/40 mesh carriers. The actual difference between A and B probably would be greater than the calculation indicates, because skewing would exert influence even within the narrow range increments listed. Within the 20/25 increment, for instance, Product B would be expected to have a higher proportion of material closer to the coarse limit of 20 mesh than would Product A. Conversely, within the 35/40 increment, Product A would doubtless have a greater proportion of particles at or near the fine limit of 40 mesh than would Product B.

Particles per pound can be translated to particles per square inch when applied at a given number of pounds per acre. For example, some representative types of granular carriers, when distributed at ten pounds per acre, and assuming perfectly uniform broadcast distribution, would yield the following deposits:

Type and Mesh	Approximate Particles per pound	Particles per Square Inch
RVM 16/30	1,210,000	1.93
RVM 18/35	2,330,000	3.71
LVM 18/35	2,565,000	4.09
RVM 24/48	6,200,000	9.70
LVM 24/48	6,800,000	10.80
RVM 30/60	11,250,000	17.90

The addition of the pesticide, plus solvents and adjuvants, if any, would increase the density of the formulation above that of the carrier alone. A 20% Aldrin granule has a density about 33% greater than the absorptive carrier used in its formulation, and a pound of the finished product contains only about 75% as many particles. Therefore, in the application of the finished pesticide formulation, there would be fewer particles per square inch than indicated in the foregoing tabulation.

It will be noted that the LVM (or calcined) type of granule contains more particles per pound than the same mesh range product of the RVM (not calcined) type. During the high heat treatment of calcination, weight is lost by expulsion of combined water. There also is some shrinkage and an increase in true density, an increase in per cent pores, and a decrease in apparent density. There is little, if any, significant difference in practical sorptive capacity between LVM and RVM types.

Under rather severe conditions of attrition, tests in the Floridin Company laboratories have indicated that RVM attapulgite granules suffer about one and one-half times as much mechanical breakdown as the corresponding LVM types. Although LVM granules may thus have an advantage in this respect, actual commercial experience has shown that good finished granular products can be made from either RVM or LVM types with reasonable care in handling and processing. Without reasonable precaution and adequate processing equipment, the finished granular pesticide may

(*Continued on Page* 91)

A Farmer's View Of Chemical Weed Control

There is no particular secret to doing a good job with chemical herbicide materials, and, by following recommended weed control practices, net farm income can be kept at a favorable level.

by Arthur Pacheco Jr.
Marana, Arizona

DURING the past several years, the price of cotton, costs of production, and yields have been uppermost in our minds because of their effect on our net income. After all, it is our net income that is of interest to the absentee owners of the cotton farm for which I am hired as farm manager.

I can't do very much about the price of cotton and, although my average yield over the last eight years is above two bales per acre, it has become increasingly difficult to get those extra high yields. For instance, the yield in one field had dropped from over 2.5 bales to the acre in 1954 to 1.8 bales by 1958. Much of this loss can be attributed to the increasing amount of verticillium wilt on our farm. Now, of course, we are doing everything possible to increase our yields by using wilt-tolerant varieties and a crop rotation program.

We have, however, been able to do something positive about our weed problem. The two weeds that give us the most trouble on our farm are Johnson grass and the annual morning glory. Gradually, the Johnson grass menace is being eliminated almost completely. In 1953, we had a $23 per acre hoeing cost, most of which was for chopping out Johnson grass. The grass was so thick in a great many places that we were forced to use a renovator with sweeps to knock down the beds and cut out the grass so that we could plant. We are in a water association and, at that time, the water company still was using men with scythes to cut the Johnson grass on the ditch banks. The men, of course, never could get around fast enough to cut all the grass before it went to seed. Every year, as a result, we had a completely new stand of grass every time we irrigated because the seed would float down our delivery laterals right onto our fields. This situation now has been corrected. The water company now controls Johnson grass on the ditch banks with applications of herbicidal oil.

We plant more than 100 acres of skip-row cotton every year, and last year we tried spraying with herbicide for the first time. We had been using a renovator with sweeps to clean out the weeds in the skips, but the spraying worked out especially well last year and I am trying it again this year. Although the appearance of the field was much nicer after renovating than after the herbicide application, we no longer have a new crop of weeds germinating every time it rains. The treatment (with Dowpon) leaves a shaggy appearance to the field because the dead weeds remain standing. We can live with this appearance, however, if our costs are lower in the long run.

The annual morning glory, on the other hand, presents an entirely different situation. In 1954, the cost for hoeing was causing some concern. The morning glories were a problem mainly on the heavier soils, but, probably because of our cotton picking machines, they were spreading very rapidly. We plannned to treat about 100 acres with herbicide in 1955. Heavy rains, however, during June and July kept the spray rigs out of the fields and the morning glories just about ruined us. We spent an average of $34.20 per acre that year for hoeing. In one field, the cost came to $56.11 per acre.

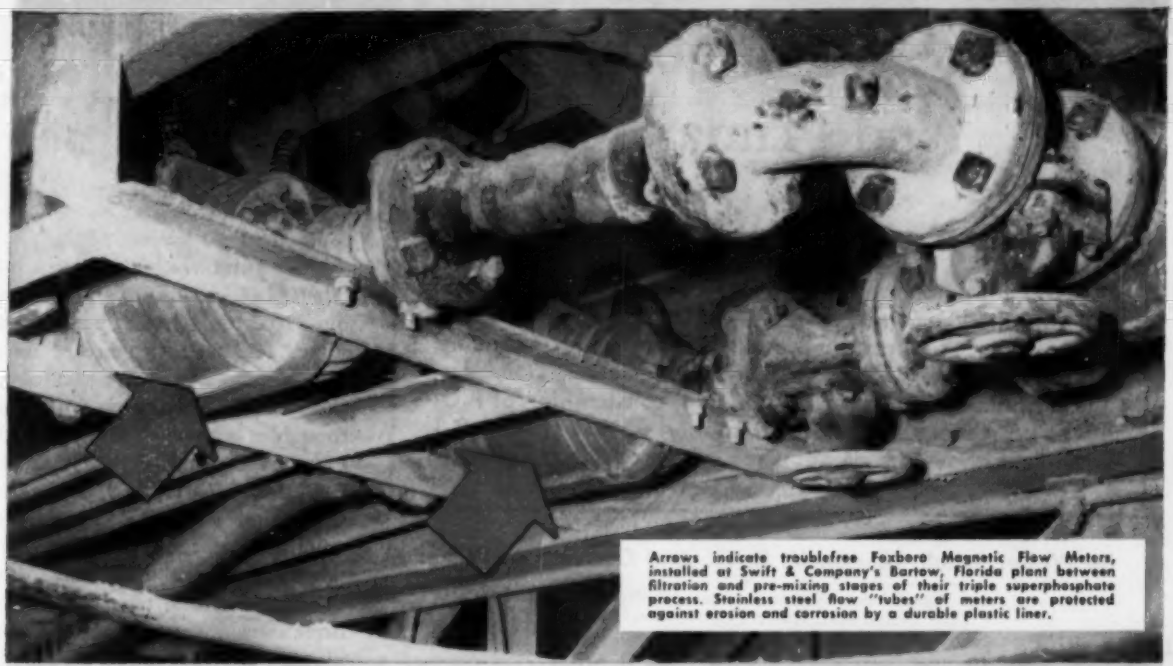
In 1956, we contracted for a custom applicator to apply Monuron to our field and our costs for weeding went down to $20.00 per acre. The custom operator applied the herbicide again in 1957 and our hoeing cost went down to $8.36 per acre. The Monuron and application costs us another $6 per acre.

By the end of 1957, quite a few farmers in our area had used the material and some reported that results achieved had been poor. It has been our experience, however, that the advanced stages of verticillium wilt look very much like Monuron damage. We apply herbicide in early July and shortly after that the first summer rains start. Shortly thereafter the first symptoms of verticillium wilt begin

(*Continued on Page* 87)

From a talk entitled "My Weed Control Program," presented at the Western Cotton Production Conference, March 7 and 8, in Phoenix, Arizona.

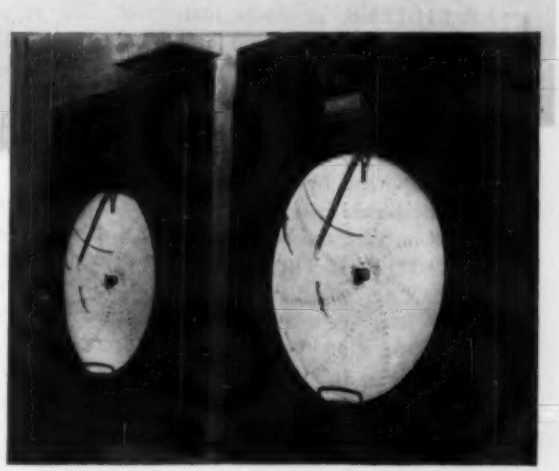
"Ornery" Phosphate Slurry Metered as Easily as Water!



Arrows indicate troublefree Foxboro Magnetic Flow Meters, installed at Swift & Company's Bartow, Florida plant between filtration and pre-mixing stages of their triple superphosphate process. Stainless steel flow "tubes" of meters are protected against erosion and corrosion by a durable plastic liner.

. . . by Foxboro Magnetic Flow Meters at

Swift & Company



By watching slurry flow rates on Dynalog Recorder charts, operators precisely regulate feed of H_2SO_4 to the reactor tanks . . . permitting better quality control right down the line.

Measuring slurry is duck soup for two Foxboro Magnetic Flow Meters now used in the production of Swift & Company's Agricola plant food. Here's the story.

The company was shooting for uniform pre-mixing and quality control. Needed was an accurate means of measuring the flow of partially filtered phosphoric acid slurry. Orifice plates, or anything that restricted flow, eroded. Pressure taps quickly fouled. Even *purged*, long-cone Venturi tubes plugged! Solution? *Electrical* measurement with Foxboro Magnetic Flow Meters. Their smooth, pipe-like interiors simply *ignore* the suspended phosphate solids. There's no erosion, no fouling. Two flush-mounted electrodes "pick up" flow measurement . . . Foxboro Dynalog* instruments record it directly on a linear scale chart. And these records are accurate to 1% of full scale!

Find out exactly how the Foxboro Magnetic Flow Meter works . . . how it can efficiently and accurately meter the "impossible" in *your* plant. Write for Bulletin 20-14. **The Foxboro Company, 135 Norfolk St., Foxboro, Mass., U.S.A.** *Reg. U. S. Pat. Off.

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MAGNETIC FLOW METERS

Preliminary Report For 1960

Consumption Of Fertilizers And Primary Plant Nutrients

The total tonnge of fertilizer consumed in the U. S. during the year ended June 30, 1960 was down 290,000 tons from the previous year. Primary plant nutrients, however, were consumed in record amounts. Consumption of nitrogen was up 3.6 per cent, consumption of P_2O_5 was up .6 per cent, and consumption of K_2O was up 2.1 per cent above the amounts for the preceding year.

by Walter Scholl, Marion M. Davis, and Caroline A. Wilker

Fertilizer Investigations Research Branch
Soil and Water Conservation
Research Division
Agricultural Research Service
U. S. Department of Agriculture
Beltsville, Maryland

FERTILIZER products marketed for farm and non-farm use in the United States during the year ended June 30, 1960, were generally lower in tonnage than in the preceding year. Total consumption based on shipments by manufacturers, sales by liquid nitrogen applicators, and on State tonnage reports was 25,022,000 tons. This was 290,000 tons (1.1 percent) less than the 25,312,672 tons recorded for the year ended June 30, 1959. There were increases in 18 States and the District of Columbia. In these, 713,000 tons more fertilizer were consumed totaling 9,605,000 tons or about 38 percent of overall consumption. California, Florida, and Georgia accounted for 526,000 tons of the increase. Consumption decreased in 31 States and Puerto Rico by 1,003,000 tons, approximately one-half of which was in Illinois, Missouri, and North and South Carolina. These changes in consumption from the preceding year were scattered through most of the regions. Increases were noted for all States in the West South Central region while decreases were recorded in all States in the Middle Atlantic and East North Central regions.

Mixed Fertilizers

Mixed fertilizers comprise 63.5 percent of the total tonnage of all fertilizer products consumed, and amounted to 15,880,000 tons —a decrease of 189,000 tons (1.2 percent) from consumption (16,069,027 tons) for the year ended June 30, 1959. In 21 States and the District of Columbia, increases were recorded totaling 429,000 tons, of which 336,000 tons were in Florida and Georgia. There were decreases in 28 States and Puerto Rico totaling 618,000 tons. Twenty States to the east of the Mississippi River recorded decreases and only eight to the west.

There were 50 grades recorded in amounts of 50,000 tons or more, totaling 12,233,000 tons. These accounted for 77 percent of the total tonnage mixtures and about 1,700 other grades made up the remaining 23 percent of the tonnage consumed. The relative use of most of these 50 grades corresponded to that of the preceding year, although at a somewhat lower level. Five of the grades—5-10-10, 4-12-12, 5-20-20, 12-12-12, and 10-10-10—were those recorded in largest amounts and their combined tonnages accounted for about one-third of the total tonnage of mixtures consumed each year. One or more of these five grades are among the grades consumed in largest tonnages in most of the States.

Materials

Materials marketed for direct application amounted to 9,142,000 tons and comprised 36.5 percent of all fertilizer products used in the year ended June 30, 1960. Included in this tonnage are 7,767,000 tons of materials containing one or more of the primary plant nutrients (N, P_2O_5, K_2O) and 1,375,000 tons of materials containing only secondary and trace nutrients, principally calcium and sulfur, largely in the form of gypsum. The consumption of materials containing primary nutrients decreased 253,000 tons (3.2 percent), whereas consumption of secondary and trace nutrient materials increased 152,000 tons (12.4 percent).

The principal kinds of materials and the tonnages marketed in each region are shown in table 1. Chemical nitrogen products comprised the only class of primary nutrient materials which increased in overall use. Although most of the products listed in this class

were used in lower quantities than in the preceding year, the higher use of anhydrous ammonia, urea, and in particular, the nitrogen solutions offset the decreases in quantities of the other product used. Consumption of the natural organics was generally lower in most areas. The use of phosphate materials decreased as a class but registered gains in the New England, West South Central, and Pacific regions. Of the listed products, consumption increased only in the ammoniated phosphates and decreased principally in basic slag and phosphate rock. Potash materials consumed as a class decreased but recorded a small increase in the South Central region. The increased use of the secondary and trace nutrient materials was due principally to the increase in the tonnage of gypsum used in the Pacific region.

Primary Nutrients

Primary plant nutrients supplied by all fertilizer products consumed during the year ended June 30, 1960, totaled 7,571,000 tons (table 2). This amount based on the guaranteed nutrient content of these products, with allowances for overruns and underruns determined from analyses of samples reported by State fertilizer control officials, was higher than that found for the larger tonnage of products used in the preceding year. This represented an increase in primary plant nutrients of 155,000 tons, (2.1 percent) from that (7,415,713 tons) consumed in 1958-59. In 1959-60, consumption of nitrogen was 2,767,000 tons, an increase of 94,000 tons (3.6 percent); that of available P_2O_5, 2,566,000 tons—15,000 tons (0.6 percent) more; and that of K_2O, 2,238,000 tons—46,000 tons (2.1 percent) above their amounts in the preceding year. These quantities establish a record high in the Nation's history easing last year's consumption into second place.

Mixtures supplied 1,052,000 tons (38.0 percent) of the nitrogen, 2,043,000 tons (79.6 percent) of the available P_2O_5, and 1,967,000 tons (87.9 percent) of the K_2O. Although the tonnage of mixed fertilizer products was slightly lower than in the preceding year, the content of primary nutrients was higher by 134,000 tons and accounted for over one-half of the increase in available P_2O_5 and K_2O. These higher nutrient contents from lower tonnage of mixtures reflect the continued upward trend in use of higher grade mixtures. The weighted average nutrient contents of mixtures consumed in 1959-60 were for nitrogen 6.6 percent; for available P_2O_5, 12.9 percent; for K_2O, 12.4 percent; and for the total of these nutrients, 31.9 percent. The corresponding averages for the preceding year were 6.22, 12.54, 11.91, and 30.67 percent, respectively.

Primary nutrients supplied by direct-application materials comprised 1,715,000 tons (62.0 per-

(Continued on Page 96)

Table I. Kinds of fertilizers consumed, year ended June 30, 1960, by region, in 1,000 tons[1] (preliminary)

Kind	New England	Middle Atlantic	South Atlantic	East North Central	West North Central	East South Central	West South Central	Mountain	Pacific	Hawaii, Puerto Rico	Total: Consumption	Total: Change from year ended June 30, 1959
MIXTURES	340	1,743	5,306	3,391	1,550	2,075	710	81	412	270	15,880	-289
CHEMICAL NITROGEN MATERIALS	15	88	819	513	725	609	515	237	989	75	4,585	31
Ammonia, anhydrous	0	3	26	79	179	72	166	46	149	1	717	35
Ammonia, aqua	0	2/	0	7	15	3	7	23	211	42	308	-74
Ammonium nitrate3/	7	31	157	150	312	264	187	77	77	1	1,231	-49
Ammonium nitrate-limestone mixtures	2/	1	221	2/	0	37	4	1	2/	0	264	-47
Ammonium sulfate	2/	12	5	206	9	14	80	45	250	85	535	-24
Nitrogen solutions	3	6	161	122	200	89	37	20	79	0	657	142
Sodium nitrate	2	10	224	2	2/	158	56	2/	2/	2/	453	-73
Urea	1	9	5	27	7	4	31	20	37	6	147	37
Other4/	2	13	20	12	3	7	9	15	41	2/	122	25
NATURAL ORGANIC MATERIALS	17	34	31	35	10	3	7	7	329	2/	473	-47
Dried manures	5	11	5	7	4	2	2	1	270	0	309	-11
Sewage sludge, all	7	16	11	27	6	1	2	4	47	2/	121	-10
Tankage, all	2	5	3	1	0	2/	0	2/	1	2/	13	-6
Other4/	3	2	12	2/	2/	2/	3	1	9	6	30	-16
PHOSPHATE MATERIALS	32	82	89	633	528	196	247	197	280	14	2,298	-229
Ammoniated phosphates5/	2/	2	1	20	187	5	121	88	131	3	559	14
Basic slag	0	0	13	0	0	58	3	0	0	0	74	-66
Calcium metaphosphate	2/	2/	1	5	12	36	2/	2/	2/	0	35	-9
Phosphate rock & colloidal phosphate	2/	8	86	471	287	16	83	2/	2/	3	675	-163
Superphosphate: 20% and under	30	65	43	46	46	89	92	16	110	1	498	-10
Superphosphate: over 20%	2/	3	2	88	149	11	66	79	80	7	403	-2
Other4/	1	3	3	3	1	1	5	13	18	2/	48	8
POTASH MATERIALS	2	9	76	204	49	68	40	3	15	10	477	-19
Potassium chloride	1	6	33	199	48	51	38	2	8	9	395	-10
Other5/	1	3	43	5	1	17	2	1	7	1	81	-8
TOTAL: PRIMARY NUTRIENT FERTILIZERS	408	1,956	6,328	4,776	2,856	2,951	1,519	506	1,965	369	21,647	-442
SECONDARY & TRACE NUTRIENT MATERIALS	2/	6	101	4	1	6	3	30	1,221	3	1,375	152
Gypsum	2/	5	97	1	1	5	1	22	1,162	0	1,294	134
Other4/	2/	1	4	2	2/	1	2	8	59	3	81	18
TOTAL: ALL FERTILIZERS	408	1,962	6,422	4,780	2,857	2,957	1,522	555	3,187	372	23,022	-290

[1] Due to rounding, totals of items may not add to column or class totals. [2] Less than 500 tons. [3] Undetermined quantities may have been used for non-fertilizer purposes. [4] Includes quantities undesignated by kind. [5] Includes all reported quantities of grades: 11-48-0, 13-39-0, 16-20-0, 20-52-0, 21-53-0, and 27-14-0.

Table 2. Primary plant nutrient contents of mixtures and materials consumed in regions and United States, year ended June 30, 1960, by kinds,[1] [2] in 1,000 tons (preliminary)

Kind	New England	Middle Atlantic	South Atlantic	East North Central	West North Central	East South Central	West South Central	Mountain	Pacific	Hawaii and Puerto Rico	United States: Consumption	United States: Change from year ended June 30, 1959
						Nitrogen						
MIXTURES	18	136	300	[illegible]	242	130	61	14	57	18	1,052	38
MATERIALS	5	27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14	1,715	[illegible]
Ammonia, anhydrous	0	2	21	65	147	59	136	38	119	---	587	28
" , aqua	0	---	0	2	1	1	1	5	62	9	81	-14
Ammonium nitrate	2	11	53	50	105	95	63	26	26	---	413	-15
Ammonium nitrate-limestone mixtures	---	---	46	---	0	0	1	---	---	0	56	-8
Ammonium sulfate	---	2	1	22	2	3	17	9	50	5	111	-10
Calcium cyanamide	---	0	0	---	0	1	2	1	1	---	6	-2
Natural organics	1	2	2	2	1	---	---	---	6	---	14	-8
Nitrogen solutions	1	2	46	20	71	9	11	2	16	0	195	65
Phosphate products	---	---	---	3	28	1	17	16	21	1	87	5
Potassium products	---	---	2	---	0	---	0	0	0	0	3	-1
Sodium nitrate	---	2	35	---	---	20	9	---	0	---	73	-6
Urea	1	6	2	12	3	2	26	9	12	2	87	17
Other chemical nitrogen products	---	2	2	1	[illegible]	---	---	2	6	---	18	1
Total nitrogen	23	135	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	2,767	94
						Available P_2O_5						
MIXTURES	40	209	460	[illegible]	[illegible]	[illegible]	[illegible]	10	50	16	2,043	[illegible]
MATERIALS	7	19	16	72	103	61	60	71	78	1	[illegible]	[illegible]
Ammoniated phosphates	---	1	---	18	58	1	30	25	12	1	[illegible]	2
Basic slag	0	0	1	0	0	5	---	0	0	0	8	-4
Calcium metaphosphate	---	---	1	1	6	10	---	---	---	0	23	-3
Natural organics	1	1	1	1	---	---	---	---	6	---	11	-1
Phosphate rock and colloidal phosphate[3]	---	---	1	13	6	---	1	---	---	---	21	-4
Superphosphate: 20% and under	6	16	8	7	10	40	10	3	40	---	150	-2
" : over 20%	---	1	1	44	60	5	28	35	9	0	[illegible]	[illegible]
Other phosphate products	---	1	1	1	---	---	---	4	8	---	13	1
Total available P_2O_5	47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	2,566	15
						K_2O						
MIXTURES	61	158	[illegible]	[illegible]	[illegible]	[illegible]	78	3	30	41	1,967	[illegible]
MATERIALS	3	3	28	[illegible]	30	[illegible]	23	2	17	6	271	-7
Natural organics	---	---	---	---	---	---	---	---	0	---	0	[illegible]
Potassium chloride	3	2	20	121	30	21	23	1	7	5	241	-6
Other potassium products	---	1	8	2	---	5	---	1	1	1	21	1
Total K_2O	64	[illegible]	[illegible]	[illegible]	213	[illegible]	[illegible]	5	47	47	2,238	46
GRAND TOTAL: N, avail. P_2O_5, K_2O 1959-60	135	565	1,686	1,711	1,177	856	597	[illegible]	[illegible]	[illegible]	7,571	[illegible]
1958-59	130	571	[illegible]	[illegible]	1,114	818	551	[illegible]	341	127	[illegible]	[illegible]
1957-58	129	519	[illegible]	[illegible]	886	726	497	106	[illegible]	[illegible]	[illegible]	[illegible]

[1] Due to rounding, totals of items may not add to column or class totals.
[2] Dashes (---) represent quantities less than 500 tons.
[3] Represents a weighted average of 2 per cent for the colloidal phosphate and 8 per cent for the phosphate rock.

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At Charleston Plant

Revamped Bagging Department Ends Production Slow-Downs

By enlarging and remodeling the bagging department, Planters Fertilizer and Phosphate Company has solved the problem of moisture and dust which had led to periodic shut-downs of the company's bagging operations for cleaning. Production in the remodeled department now is up 25 per cent.

ALTHOUGH the problem of dust is common to virtually all fertilizer manufacturing establishments, fertilizer plants located in Charleston, South Carolina are faced with the added factor of humidity. The moisture in the air at Charleston soars in the summer, fall, and winter, to say nothing of spring, and it is a serious factor in slowing bagging operations at fertilizer plants there.

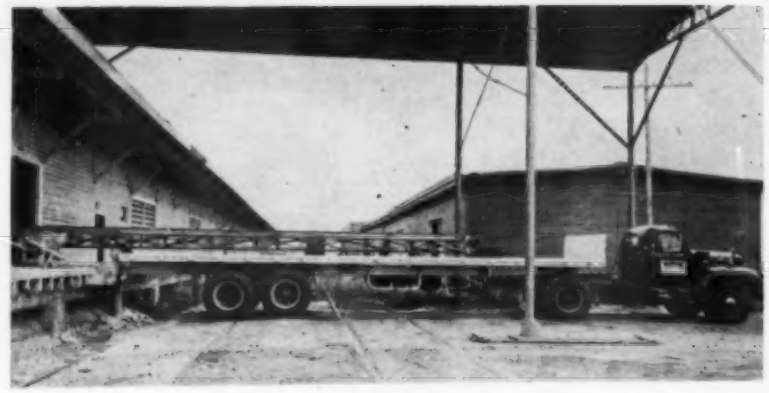
A. C. Palmer, general manager of Planters Fertilizer and Phosphate Company of Charleston, said recently, "Since we have this high humidity—the highest of any city along this area of the coast, we have to contend with it the year around, mainly in maintaining production in the bagging and shipping department." Planters produces complete mixed pulverized fertilizer and complete granular fertilizer, by the TVA process, at its plant on King Street in Charleston for distribution throughout South Carolina and parts of North Carolina, Virginia, and Tennessee.

Last year, Planters officials turned their attention to a solution to the problem of moisture and dust which had led to periodic shut-downs of the company's bagging machine for cleaning, with a consequent loss of production. With the assistance of packaging engineers from Union Bag-Camp Paper Corporation, New York, the bagging and shipping department was enlarged and remodeled.

A major change in the bagging department was the installation of Union-Camp's I & C Bagger. The machine which Planters had been using was equipped with an open lever system which lent itself to the accumulation of dust and moisture, leading to occasional shut-downs. The I & C Bagger, by comparison has a dust-sealed lever system and dial scale which resist dust and moisture accumulation.

Production in the remodeled department is now up 25 per cent and slow-downs for cleaning out equipment have come to a halt. In addition, an I&C conveyor system

An overall view of the modernized shipping and bagging department, which now is on a straight-line basis.



Following the addition of a 36-foot truck conveyor at the Planters Fertilizer and Phosphate Co. plant, it now is possible to load two trucks, one at each door, without taking out time for switching trucks. As soon as one conveyor is loaded, the feed line is switched to a cross-over conveyor.

was installed that makes it possible to load as much as 400 tons a day of fertilizer onto trucks. Furthermore the loading operation requires only two men. Under the old conveyor system, one man was required at the end of the conveyor, one on the truck, and five men were required to operate hand trucks.

The speed-up in the conveyor system was made possible by the addition of a 36-foot truck conveyor. This, plus a cross-over conveyor, makes it possible to use two doors for loading trucks instead of one. With the trucks standing by, one extension of the conveyor is placed over one truck. As soon as this vehicle is loaded, the feed line is switched to the cross-over conveyor which drops bags on another I&C conveyor. Thus, the second truck is loaded without switching.

"By using this system, when we have one truck loaded and ready to go, the other is in the process of being loaded," Mr. Palmer reports. "The loading of the second truck now takes less time than previously was required to switch it into the position of the first truck," he adds.

The equipment employed at the Charleston plant (the company operates another plant at Charlotte, N. C. to serve that area) for the manufacture of pulverized fertilizer includes a complete hopper system for raw materials which are conveyed to a two-ton Atlanta Utility mixer where nitrogen solution is injected by pressure and materials are blended. From this point, the complete pulverized fertilizer is conveyed to storage.

The bagging and shipping area, mounted on an elevated floor some twenty feet wide, is conveniently located near the bulk storage area under the new arrangement. On the adjoining bulk floors, scoop bucket trucks move the product over the ground to an opening back of the elevator pit where a bucket elevator lifts it 42 feet from where it is dropped to a screen. From there, it goes into a hopper and down to the scales. Two hoppers are located immediately over the bagger and sewer. One of these is used as a mixing hopper for special grades and, when this one is put into operation, the flow to the bagger by-passes the other hopper.

Sulfuric acid at Planters is produced by the lead chamber process and for superphosphate production a 60" high-side Raymond mill is used to grind phosphate rock. Other equipment includes a 40-ton Sturtevant den and a 50-ton per hour pulverized manufacturing unit and three shipping units. The company's complete 20-ton per hour granular plant makes it the only plant in South Carolina to have a granular operation.

The most popular grades produced at the Charleston plant are 4-8-12 pulverized and 4-12-12 granular.

Much of the fertilizer output is handled in multiwall bags, although some burlap bagging still is carried on. According to Mr. Palmer, the use of multiwalls is on the increase because of their adaptability to color printing and better display potentialities.

With the automatic open-mouth bag packer, the company is maintaining a production rate ranging between 17 and 22 100-pound bags per minute. Furthermore, the open faced dial scale on the machine is credited with a reduction in rate variations of two to four ounces per 100-pound bag.

A minimum of space is required for this operation and it was installed without major alterations to the fifty-five year old plant. While a large part of the output now is shipped by truck, the bagging department is situated on a railroad siding and, when it is necessary to load a freight car, the recently-added conveyor can be put to use for that purpose also.

Regarding operations with the burlap bags, Mr. Palmer reports that 200-pound bags were filled at the rate of 13 to 15 per minute on the I & C Bagger. "We are maintaining these speeds with a satisfactory weight accuracy of two to four ounces variation, and it would be possible, I believe, to bag up to 600 tons per day off the one machine," Mr. Palmer said.

Planters is one of the oldest fertilizer companies in the Carolinas. It was started in 1906 by J. Ross Hanahan, who still is active as chairman of the board of directors. Other officers are W. O. Hanahan, president; J. R. Hanahan, Jr., vice president; J. S. Hanahan, secretary; and Mr. Palmer as general plant manager.

The company produces fertilizer on a year-around basis and, although they do not offer small package products for home and garden use, they do mix various pesticide formulations with the fertilizer to meet customer demands.★★

STABILIZATION

Of Dry Pesticide Formulations

Introduction of the synthetic organic insecticides in the 1940's emphasized the problem of chemical compatibility in dry pesticide formulation. Finished formulations often are limited to those combinations of pesticides and diluents which are chemically compatible.

This article is based on a paper presented at the 139th ACS meeting in St. Louis by Eugene P. Ordas, Velsicol Chemical Corp.

PERHAPS the most critical problem in dry pesticide formulation which necessitates compromise and adjustment is chemical compatibility. Introduction of the synthetic organic insecticides in the '40s emphasized this problem, especially with the mineral carriers and diluents. Product instability was generally assumed to be caused by such factors as pH, catalytic amounts of heavy metal impurities, moisture, air (oxygen), light, temperature, etc. Oftentimes, product decomposition could be traced to one or more of these factors.

Researchers[1] in 1944 reported that as little as .01% anhydrous ferric chloride would catalyze the dehydrochlorination of technical DDT. They found that fullers earth and some other mineral products also showed catalytic activity, and suggested that this probably was due to the presence of small amounts of iron compounds. Present day findings on the relative catalytic activity of mineral species agree in general with data in Table I.

Many commercial laboratories, including those of basic producers, have independently studied the compatibilities of insecticides with mineral diluents and carriers. It was found in early work that practical concentrations and the physical properties of the finished formulations were often limited to those combinations of pesticides and diluents which are chemically compatible.

To meet the demand for dry flowable concentrates of the liquid and low-melting insecticides, sorbent carriers such as diatomaceous earths and attapulgites are required For solid and high-melting insecticides, relatively low sorbency carriers and diluents such as kaolinites and talc are physically satisfactory, even for high concentrations, because simple dry-blending techniques followed by fine grinding are adequate for producing homogenous flowable powders.

In the case of heptachlor, (see Table II) it was found that the deactivator requirement decreases generally as the bulk density increases, and as the sorptivity decreases. An exception to this generalization is the class of diatomaceous earths, which, although very high in sorbency and very low in bulk density, are intermediate in their requirement of a deactivator. It also is interesting to note that the cost of these materials increases directly with their sorbency. Were it not for the need of highly sorbent carriers for preparing concentrates of liquid toxicants with

Table I.
Catalytic thermal decomposition of DDT heated one hour at 115-120°C.[2]

	mols HCl released per mol of DDT		mols HCl released per mol of DDT
DDT	none	hydrated lime	none
kaolin	1.03	calcium oxide	none
bentonite	.32	talc USP	none
alumina	none	Pyrax ABB (sample 1)	.04
iron powder	none	Pyrax ABB (sample 2)	.91
Fe_2CO_3	none	talc, west coast	1.03
$Fe\ Cl_3$	3.00	talc, Vermont	none
fuller's earth	1.0	talc, off color, Md.	1.05

It should be noted that the samples of Pyrax ABB and talc which showed the marked degrees of activity may have contained traces of available iron.

Table II.
Properties of some common types of pesticide carriers and diluents

	% Deactivator H[3] req'd for heptachlor	oil sorption gms/100 g
diatomaceous earth	1 - 5	100 - 200
attapulgite	6 - 11	100
montmorillonite (incl. bentonite)	4 - 12	23 - 70
kaolinite	0 - 3	25 - 54
pyrophyllite	0 - 1	25 - 50
talc	0 - 1	24 - 40
limestone	0	5 - 8

moderate bulk density, the talcs, kaolinites, etc., and more compatible diluents would be preferred.

Rate of heptachlor decomposition on mineral carriers and diluents has been found to depend on the catalytic activity of the mineral;—it also has been found that this activity is a function of surface acidity.[4] Using a series of indicators[5] (known as the Hammett indicators), surface acidity of a mineral can be estimated.

In dust formulations, the rate of decomposition of heptachlor is accelerated at elevated temperatures. The accelerating effect of elevated temperatures has been observed in studies on storage stabilities of dieldin and endrin, malathion, methyl parathion and aramite. It has been shown also that the rate of decomposition is independent of the toxicant concentration and that decomposition is a zero order reaction.[6]

A large number of additives studied[7] as heptachlor deactivators, included nitrogenous bases such as urea and hexamethylene tetramine, inorganic bases such as lime, sodium carbonate, and calcium carbonate; and oxygenated compounds such as alcohols, ketones, glycols, ethers, etc. Of this group, the oxygenated compounds showed the greatest effectiveness.

In consideration of such physical properties as vapor pressure, flammability, etc, mono-, di- and tri-ethylene glycols were studied as possible clay deactivators. Using from 0 to 7 per cent diethylene glycol calculated on the weight of attaclay, the rate of heptachlor decomposition was shown to decrease as the amount of deactivator was increased. Similar results were obtained in studies on Barden Clay (a kaolinite) and Celite 209 (a diatomite). Other studies show that diethylene glycol could be used effectively to deactivate a wide variety of mineral carriers and diluents and that the quantity of deactivator required for heptachlor formulations is inversely proportional to the pKa (surface acidity) of the untreated minerals.

The susceptibility of methyl parathion toward catalytically active carriers and diluents has been described in manufacturers' technical bulletins. It is decomposed by moisture, alkalies and strong acids, heat and surface acidity. Because of this, extreme precautions must be taken in the selection of carriers and diluents, process conditions and storage conditions. At room temperature, a 10% methyl parathion formulation on an undeactivated attapulgite will decompose between 35 and 40 percent within 15 minutes. By pre-deactivation of the carrier before impregnation, this rapid rate of decomposition can be considerably retarded.

Because methyl parathion decomposes rapidly in the presence of alkali, alkaline deactivators should be avoided. HMT, for example, which in water has a pH of 8 to 9, is considered unsuitable as a deactivator for methyl parathion carriers and diluents. On the other hand, glycols and glycol ethers, which are neither basic nor acidic, simplify the choice of deactivator for many toxicants and their formulations, which are sensitive to alkalis or acids.

The attapulgites frequently are used as carriers for methyl parathion dust concentrates, because of their sorbency, moderate cost, desirable flowability characteristics, etc., but they need as much as 10% diethylene glycol for deactivation. The diatomaceous earths also may be used as carriers for high concentrations of methyl parathion, because of their very high sorbency and lower deactivator requirement, which is about 4 per cent of diethylene glycol. They, however, cost more than the attapulgites. The effect of their low bulk density and possible dustiness must be considered, as they may affect the desired handling properties of the concentrate.

Diluents of lower cost and lower surface acidity such as talc, pyrophyllite and calcium carbonate have been recommended by many basic producers of methyl parathion for letting down to field strength the methyl parathion concentrates prepared on the more sorbent carriers. In general, technical bulletins of the basic producers classify mineral type carriers and diluents for methyl parathion, according to degree of activity as follows:

least active
- calcium carbonates
- talcs
- pyrophyllites

moderately active
- diatomaceous earths
- kaolinites
- micas
- vermiculites
- synthetic calcium silicates

most active
- attapulgites
- montmorillonites

DDT may be considered a relatively stable material when formulated alone as a 50 per cent dust base, — and it is doubtful if many formulators use any deactivator when it is formulated with an active carrier such as attapulgite. Normally, this would create no problem. However, when field-strength dusts with methyl parathion (such as 2.5 methyl parathion-5 DDT) are prepared by cut-back from their respective concentrates, an unstable product may result unless the surface acidity of the DDT concentrate is deactivated to over pKa 3.3 with a neutral de-

(*Continued on Page* 88)

In the development of processes for the manufacture of dry pesticide formulations, practical consideration must be given to the order of addition of the formulation ingredients.

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AG CHEM

Production Round Table

by F. T. Nielsson
International Minerals & Chemical Corporation

Rotary Ammoniator and Granulator Technology

In the seven years that have passed since the first pilot-plant demonstration of the rotary ammoniator, plant experience has resulted in relatively few changes. Certain techniques, however, are better than others and a knowledge of them may be helpful to operators who have not taken advantage of them. Part 1 of a two-part report.

THE rotary ammoniator was publicly unveiled to the industry on September 15, 1953 (1, 2). Since that first demonstration over 85 installations have been made (3), indicating that the equipment must have some of the features that were claimed for it. These were a high absorption of free ammonia and an ability to handle fertilizer material undergoing physical transition into the plastic stage with a minimum of power and external accessories.

Although some installations utilize the rotary ammoniator only for its ammoniating characteristics, in most instances its ability to handle material beginning to plasticize has resulted in the equipment finding its main field as the ammoniation component of a fertilizer granulation process.

In the seven years that have passed since the pilot plant demonstration, plant experience has resulted in relatively few changes in the ammoniator. Of course, not all the shortcomings of the rotary ammoniator have been solved, but enough information is available to indicate that certain techniques are better than others. It is the aim of this article to discuss these techniques in the belief that they may be of advantage to operators who have not heard of them, or have not taken advantage of them because of a lack of understanding of the underlying principles.

Bed Action

The rotary ammoniator depends upon a rolling bed for efficient operation. The motion of the bed engenders mixing of the stream of raw materials, brings fresh materials into contact with the ammoniating solution and/or mineral acid, aids in agglomerating particles, and provides an orderly displacement of materials from the feed to the discharge end.

When the rolling action is weak or absent, wet or soupy spots develop because fresh solids no longer are brought into contact with the fluid streams. The resultant over-ammoniation brings about loss of ammonia, and the over-acidulation of nitrogen solution with mineral acids results in the generation of nitrogen oxides. Agglomeration is a function of the

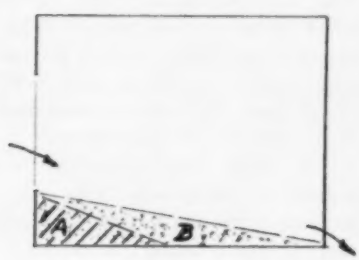

Figure 1.

Figure 2.

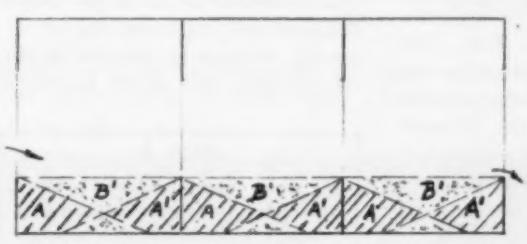

Figure 3.

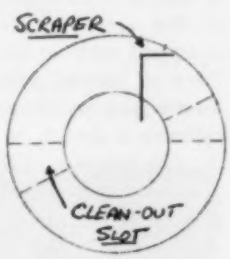

Figure 4.

speed of rotation of the particles undergoing agglomeration, and a weak rolling bed with slowly revolving particles results in the formation of large balls if plasticizing conditions exist.

The rolling action is imparted to the bed by the wall and the end dams of the cylinder that comprise the drum of the ammoniator. The function of the dams appears to be more important than is the action of the cylinder wall. The latter finding is one not fully appreciated by operators and equipment manufacturers.

The pilot plant ammoniator in the 1953 demonstration was of "square" design; that is, the length equalled the diameter in common with the majority of batch ammoniators of that day. The discharge dam was one-quarter the diameter because that was the height that appeared to be the best compromise between a rolling bed, good ammonia absorption, and resistance that would not displace the distributor. The nitrogen distributor was positioned 2 inches from the shell for the same reasons. As plant scale ammoniators were built, the first ones were of "square" design also; that is, 6′ x 6′ or 7′ x 7′, and bed action appeared satisfactory. In search of longer retention time at higher production rates, later versions were made longer in length than in diameter. Soon stories were heard of flash fires, overagglomeration and excessive losses of ammonia. Although some of the problems were due to the use of 98% or 100% sulfuric acid, I believe most of the difficulty could be traced to insufficient bed action.

Figure 1 illustrates the theory of how a rolling bed is generated at the feed end of a cylinder equipped with an inlet dam. The "area of action" generated by the intersection of the dam and the cylinder is shown in the triangle *A*. The intensity of the rolling bed decreases in triangle *B* as it leaves area *A* and is almost non-existent as it overflows the discharge lip.

In Figure 2, the addition of

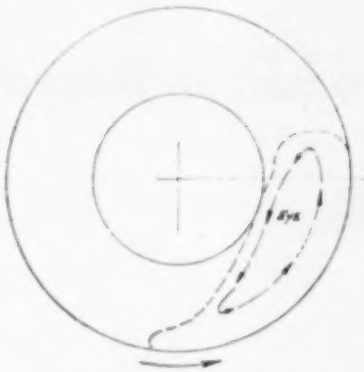

Figure 5.

a discharge dam has created another area of action that intersects with that at the feed end and transfers its energy to the entire bed.

As the dams are moved further away from each other the "areas of action" caused by the intersection of the dam and the cylinder cease to contact each other and "dead" areas result. In these dead areas there is a minimum of movement, resulting in high concentrations of liquid caused by puddles of solution, acid and reacted solids. The dead area is increased further in some cases by operators who believe that the deeper the distributor is under the bed, the better the absorption, and therefore they position the distributor right against the shell, effectively stopping the transmission of lifting energy from the shell to the particles in the bed.

As long as the ammoniator is of square design, and the height of the dams is at least ¼ the diameter, with the distributors forming a compact bundle 3 to 4 inches from the shell, it has been found that rolling action is automatic, even with a smooth shell. As the length increases in proportion to the diameter, without an increase in the dam height, bed action begins to decrease in the center of the ammoniator where usually the greatest percentage of solution is being added. This is particularly noticeable with stainless steel shells that present a relatively smooth surface.

A simple way to overcome the lack of rolling action in long ammoniators would be to provide a regular dam at the half way point. However, this action would necessitate the use of dual distributors and scrapers and would complicate the installation unduly.

A more workable compromise is to provide a series of 2 inch high dams on 2 foot centers along the length of the ammoniator, with the distributor bundle 2 to 3 inches above the intermediate dams. The scraper bar needs only a short indentation to clear each dam. A six-inch opening in each dam, with openings staggered, will allow the cylinder to empty when needed, as shown in Figures 3 and 4.

The system of intermediate dams described above has been effective in eliminating dead areas in extra long ammoniators.

Other means for promoting bed action are to increase the height of the discharge dam, thus extending the "area of action", or to use a scalloped edge scraper. The scalloped scraper will cut a series of grooves in the crust adhering to the shell and each groove will act as a miniature dam. Both of the above increase the resistance of the cylinder to being turned.

In many cases, installing intermediate dams will cause overloading of the drive motor because more energy is being transferred to the bed. This is analagous to the increase in power consumption by a mixer motor when baffles are installed in a tank containing fluids being mixed.

PART II

of this report on rotary ammoniator and granulator technology will appear in the June issue of Agricultural Chemicals.

Granulation

If one examines a transparent cylinder containing free flowing particles, e.g., sand, while the cylinder is being rotated in a man-

(*Continued on Page* 90)

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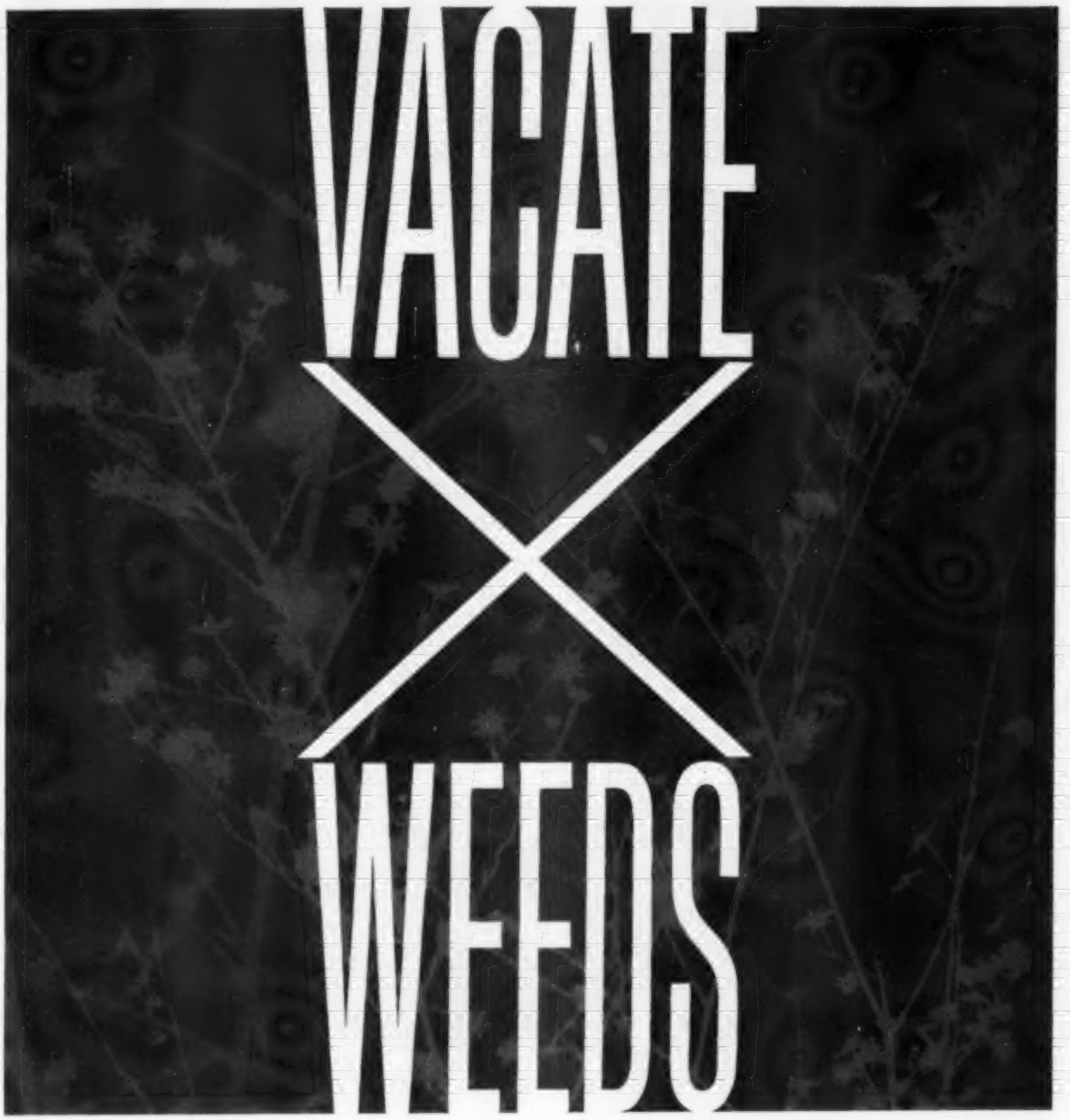

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AGRICULTURAL CHEMICALS

AG CHEM

Fertilizer Views and News

by Vincent Sauchelli

Dr. Sauchelli is a Consultant to the Agricultural Chemicals Industry.

Research Creates Food Abundance

AFTER my long visit in India and other Asian countries and my return to our land of plenty of food and other good things in life, I am convinced our people are better off struggling with the problem of surplus than with the problem of not enough. Why is it that we have so many persons in our country who cannot appreciate how fortunate we are to have so productive and versatile an agriculture? It is the envy of a great many less fortunate nations. We read in newspapers and magazines that the rate of farm production in the United States far exceeds that of population growth; the farmers have increased in efficiency faster than the number of people has grown. Is that fact so regrettable? I believe it is not.

Things have changed vastly on our farms, even within the memory of most of us, especially in those factors that impinge on methods of farming and varieties of crops. Less than 45 years ago, farmers generally followed a walking plow, drudged at forking hay, hand-milking cows, and fetching water by hand; farms had no autos, tractors, combines, field balers, side-delivery rakes, corn-pickers, and milking machines. Electricity was the privilege of a very few farmsteads. Imagine the conditions when there were no paved roads, buses, radio, television, county agents and extension services, rural credit agencies or oil and gas heat. Those were the so-called "good old days." Good for what! Our farms now are almost completely mechanized: plowing, seeding, combining, trucking are done with powered equipment. The American farmer commands more than 33 horsepower per worker. Improved varieties of crops and soil management practices and greater use of commercial fertilizers have greatly helped to boost crop yields per acre with considerably less labor. For example, in 1800, 370 hours of farm labor were required to grow and harvest 100 bushels of wheat; in 1900, about 100 hours; by 1940, 43 hours; and, at present, about 25 hours. Within a century and a half, our farms have progressed from about 4 hours to produce a bushel of wheat to about 1 hour to produce 4 bushels.

How different is the picture of food and fiber production in India and other Asian countries! In those countries, except Japan, human and animal muscle still provide the power on their farms, and the lack of commercial fertilizers and pesticides and improved soil management practices keep crop yields per acre to a bare subsistence level. Farming in those countries is usually unalloyed drudgery.

Should our farm abundance be deplored? Should agricultural research projects be suspended to allow consumption to catch up with production? That is the counsel of despair. Perhaps we should change the emphasis of research: research to increase output should be slowed up for a while in favor of research on the industrial uses of farm crops and on ways of cutting production costs without increasing output. Many experts have proposed this change in research goals. The proposal seems wise and practical. Perhaps, also, farmer and government agencies should do much more hard selling in the food markets. Millions of our people, say the experts, now spend money on food more from necessity to eat rather than for balanced nutrition or the pleasure of enjoying good, well-prepared meals. They prefer to economize on food so as to be able to buy other things. Competition for the consumer's dollar is terrific: modern maketing techniques must be adopted if farmers want to capture their share of it.

In this connection we inevitably come back to a discussion of future needs with increase in population. It is estimated that, by 1975, the population of the United States will be about 200 million and in 50 years about 360 million. Will those future Americans go hungry? To maintain the present living standards with no improvements in the diet (even though needed) in 50 years, our farms will have to supply twice as much food and other products, that is, double the crop production and more than double live-stock production. These increases are to be achieved on but little more land and perhaps considerably less manpower. Remember, at present, American farms are using less than 10 per cent of the Nation's total labor force.

Now, 50 years is not a great span of time. The year 2000 is not so distant that our people can af-

(*Continued on Page* 87)

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AG CHEM

Washington Report

by Donald Lerch

THE consumer, who has long had a role in the policy-making machinery of the Federal Food and Drug Administration, now is likely to be given a role in forming some U. S. Department of Agriculture policies as well.

In FDA, the consumer's voice is heard through a system of consumer panels. Through these panels, their views are made available to the top policy makers in the Administration. The plan for USDA, however, appears to favor a more formal arrangement. Under it, consumers would serve on elected farm commodity committees. These would be set up to determine programs for individual commodities if proposed farm legislation is passed by Congress.

Agriculture Secretary Orville Freeman's view is that, "whenever it is determined that a program is needed for a particular commodity, at least one member of the commodity committee selected to formulate this program shall be appointed to represent the consumer point of view."

Secretary Freeman says that farmers have managed agriculture so successfully that the United States is now the world's leading agricultural nation. What is needed now, he adds, is some means for managing this productive capacity to meet human needs. In all such programs checks and balances will be needed to protect the public interest and one such balance would be "to maintain the voice of the consumer in the formulation of any program dealing with the farm commodities produced in this country."

Secretary Freeman appears to be concerned primarily with means for reducing surpluses of a few key commodities. However, his plan may introduce a new factor in official agricultural circles of special interest to agricultural chemicals manufacturers.

As industry leaders have pointed out many times, consumers' lack of intimate knowledge of farm production problems on occasion has thrown up a real obstacle to agricultural progress. Both industry and government have spent many hours in educating consumers as to why pesticides and even chemical fertilizers have to be used in food production.

If consumer representatives are to become part of the official farm family, the chances are that even greater efforts must be made to make sure consumers understand more details of farm production. Looking on the bright side, consumer members of commodity committees might be in a good position to learn the facts first-hand and be able to pass them on to other consumers.

Whatever else might be said about this proposal by Secretary Freeman, it does underscore a major challenge of our time. Communications is becoming an ever larger problem, and it must be solved if agriculture and the agricultural chemicals industry are to continue to move ahead.

Extension Service Head

One of the developments in the U. S. Department of Agriculture which has aroused much interest among fertilizer manufacturers is the announcement by Secretary Orville Freeman that Dr. E. T. York, Jr. is to be the Administrator of the Federal Extension Service.

Dr. York will come to his new post from the Alabama Extension Service, which he has directed since 1959. Immediately prior to that time, however, he was Eastern Director of the American Potash Institute and active in such groups as the American Grassland Council.

His sound grasp of the need for improved fertilization may be reflected in the work of USDA's Extension Service in Alabama, where he gave full support to a program stressing the increased income farmers can get from a sound fertilization program.

He told fertilizer people meeting in Atlanta that "these fertility programs have proved to be an excellent extension tool and in many cases have been responsible for the county agent's having reached farmers with whom he heretofore had been unable to communicate." He added, "In some counties, where these programs have been carried out, farm income has been increased in one year's time by several million dollars."

Non-Farm Market

The National Plant Food Institute is stepping up its program to expand the use of fertilizers in the growing non-farm market. Every new lawn and every old, run-down lawn in the country stands as a potential for the sale of fertilizers and pesticides as well.

To make home-owners and other non-farm users aware of what

fertilizer can mean in terms of better lawn, NPFI this year distributed five articles by its Chief Agriculturist, Jess Garman, to 1,950 newspapers in the south, midwest, and northeast.

Now they are following up with production of a motion picture on turf fertilization for use by NPFI members, by schools and colleges, by garden clubs, and others concerned with lawn beautification.

Well-kept lawns and gardens are becoming so much a part of outdoor living, that some in the industry even feel it would make sense to provide each new home owner with instructions on how to grow and maintain a good lawn at the same time that he receives materials on how to operate the many new appliances inside his house.

They argue that the home builder would benefit, too. For he gains from selling attractive outdoor living today as well as convenient indoor living.

Heavy Legislative Year

By all odds, 1961 so far has been one of the heaviest legislative years for the pesticide industry. NAC has been kept busy reviewing some 400 bills introduced in the state legislatures, and the legislative season is not completely over.

The vast majority of bills, however, have taken into consideration the practical needs of farmers and others as well as the requirements of consumers. This can be taken as a tribute to the growing public understanding of pesticides' vital role in modern life.

Chemicals In Foods

As we have reported earlier, the problem of chemicals in or on foods is rapidly becoming of international concern. Due at least in part to the volume of anti-chemical publicity here, other countries are taking a hard look at the safety of foods imported from the U. S.

The latest entry into this field is West Germany. The irony here is that German scientists are credited by some with launching chemical agriculture with early work on chemical fertilizers.

The current problem in West Germany apparently was set off by the arrival in Germany of oranges colored and treated with a chemical to prevent fungi damage during transit. German housewives are now asking for more information.

NAC, which has taken a position of leadership in providing facts on food safety to American housewives, is making its slide film "Pesticides — Boon To Mankind" and other materials available for use in West Germany.

Meantime, NAC is launching a new program to consist of one-minute transcribed radio reports to consumers. The one-minute reports will cover the many ways in which the proper use of pesticides improves man's food supply, his health, and his comfort. Included in the reports will be quotes from leading doctors, scientists, and political figures.

Helicopter Association

Fertilizer and pesticide manufacturers may be interested in an association which has just moved to Washington and will play a part in fertilizer and pesticide application. It's the Helicopter Association and its members are business firms which hire out helicopters for crop dusting, air taxi service, powerline patrol, forest fire fighting and so on.

Although in existence for 13 years, the Helicopter Association just this year established a permanent full time staff, headed by Executive Secretary John L. Pennewell, and moved into headquarters in the Landmark Building, 1343 H Street, N. W., Washington 5, D. C.

The Association now has about 60 member firms of a total potential of over 260. The entire industry is now doing $50,000,000 worth of business a year, part of it in crop dusting.★★

Constant Vigilance Required To Safeguard Food Supplies

POISONING pests without poisoning people is the complex problem facing today's growers and food processors as they work to provide consumers with safe, wholesome food of good quality, Carl G. Smith, produce director for Gerber Products Co., Fremont, Mich., told the Michigan State University conference on residues in foods March 27-28. Mr. Smith said that the job is a tough one and requires constant vigilance.

The wholesomeness of our food supply and the protection of the consumer is foremost in the minds of everyone connected with the growing, packaging, and selling of food, he said. Today's consumers, he explained, demand superior quality and improved sanitary standards, and chemicals offer the only economical means for controlling insects or diseases that can damage or destroy crops.

Properly used, he said, chemicals do great good; improperly used, some can be dangerous. We must use agricultural chemicals with the same care with which we use chemicals in our medicine cabinets, he warned. Wide public understanding of the facts about chemicals is essential, he continued, if our farmers and food industry are to continue giving us the present abundance of good foods we can enjoy in safety.

Mr. Smith suggested that processors adopt the following four-point approach to the food residue situation:

1. Remember that our first responsibility, in this area, is to supply the consumer with "safe" food.
2. Work with federal and state agencies, trade organizations, universities, and others in providing information from the grower to the processor to insure 100 per cent compliance with pesticide labels.
3. Use properly equipped laboratories to check selected samples of raw and finished products.
4. Cooperate fully with the various regulating agencies.

Safety Factors In Agricultural Aviation

Success will accompany the aerial application team in which the members are able to take a broad and sympathetic outlook on the problems of other members of the team. Safety should never be subordinate to the desire to make money.

LOW flying has been defined as follows: "Flight at such an altitude that the pilot's attention must be given in the main to the avoidance of the ground or obstacles on the ground." From this definition, it can be deduced that the pilot must be able to fly his aircraft automatically, and he must be reasonably experienced.

Except when he is going from place to place, the agricultural pilot nearly always is flying within reach of the various obstacles on or near the ground. It is not a job, therefore, for the inexperienced pilot. The trouble is that the inexperienced pilot does not always realize that he has to think further ahead when he is flying at, say 2,000 feet above the ground. It is probably true to say that, for every foot a pilot flies above the ground, he has double the time to think, when it comes to avoidance of contact with the ground or an obstacle on the ground. It is the converse of this that is vitally important in low flying. Failure to recognize this point has led to many quite unnecessary accidents in all types of flying.

While there is nothing inherently difficult in low flying, therefore, it is well to attempt it with a very full realization of what a mistake can lead to, and it is vital to remember either to think farther ahead than usual, or to quarter the reaction time.

The foregoing may suggest that pilot error is the main cause of accidents in agricultural aviation. This is not the case, and the following are various ways in which those concerned with agricultural aviation can make contributions to flight safety.

Aircraft Manufacturer

1. Give the pilot as good a view in all directions as possible. This, like a good many other things, is bound to end up in a compromise, but one of the pilot's best hopes of survival is the ability to see obstacles in time to avoid them.

This article is taken from the report of the First International Agricultural Aviation Conference, published in 1960 by the International Agricultural Aviation Centre, The Hague, Netherlands. It is based on remarks made at the conference by W. D. Miller (Wing Commander), Colonial Pesticides Research Unit, England.

2. Try and design the aircraft so that any fractured part of it does not, in the event of a crash, impale the unfortunate pilot.

3. Design the aircraft, spray gear, and dusting gear as one entity — and avoid hanging bits on afterwards as an afterthought.

4. Position the controls of the spray gear just as carefully as the engine and flying controls are positioned. The easy manipulation of the gear is vital to the pilot for it must be done at a time when he can least afford distraction from looking where he is going.

5. Manufacturers should not be influenced by the operator who says he wants an aircraft with no frills, and that electrics and hydraulics and pneumatics only add to his initial costs and maintenance troubles. If a few dollars a year on initial cost and maintenance will save a pilot's life, then it is well worth it.

Pilot

1. A pilot should not try this type of flying until he has had quite a bit of general flying experience.

2. He should not give way to pressure and try to do a job in conditions which all his experience and knowledge tell him are unsuitable.

3. He should not be too proud to ask someone else for an opinion if he is unsure of something. It may save his life.

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Warren Nichols

David Setter

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How To Obtain Best Results From Chemical Defoliation Of Cotton

Applying defoliants too early will result in the loss of top immature bolls, or, at least, cotton from such bolls will be inferior in quality and yield. Applying defoliants too late may result in a poor leaf drop due to low temperatures. Timing is important.

by Howard E. Ray
Extension Cotton Specialist
University of Arizona, Tucson

RAPID progress toward complete mechanization of cotton production has been made in the West during recent years and mechanization of the picking operation has focused on chemical defoliation as a means of increasing harvest efficiency and maintaining lint quality. The use of defoliants now is an established practice in California and the lower elevations of Arizona, but cotton growers in New Mexico and the higher elevations of Arizona have been more hesitant to adopt this practice because of their shorter growing season. In all areas, however, success with defoliation has been variable. Some of the factors which help determine the success or failure of a defoliation job follow.

Plant Condition

Plants that get off to a good start in the spring, grow well throughout the season, and are in cut-out but still active at the time of defoliation are most apt to respond satisfactorily to chemical defoliation. Soil conditions, uniformity of stand, irrigation, fertilizer, insect control and weed infestations all play a part in determining plant condition.

Land and soil conditions. For best results in production and defoliation, cotton should be planted on relatively uniform land which has been properly graded to permit adequate and even water penetration. Unfortunately, this is not always possible, as western cotton growers are often plagued with diverse soil conditions which result in uneven plant growth and maturity. For example, soil in one block at the Cotton Research Center near Phoenix is progressively finer textured from the south to the north side of the field. When a chlorate-type defoliant was applied last October, plants on the south side were in an ideal condition for defoliation and leaf drop was excellent. On the north side of the same field, plant height averaged almost 2 feet greater, plants were still growing actively, and leaf drop was very poor. In this field, as in many others, the areas were too irregular to permit special fertilization, irrigation, etc. Any practice, such as turning under manure or crop residues, which will help to "even out" plant growth also will make defoliation less chancey.

Stand. Defoliation is easiest in even stands with uniform plant development and maturity. If a stand is uneven and plant development and boll maturity are irregular, defoliation also will probably be irregular and incomplete.

Irrigation. A cotton crop should be provided a consistent, adequate supply of moisture during its growing and fruiting life. Delay of a single irrigation at a critical period may lead to unsatisfactory results when defoliation is attempted. Excessive irrigation and fertilization may lead to lush, rank growth, defoliation difficulties, and troublesome regrowth.

The last irrigation is the most important moisture factor relating to defoliation. The last irrigation should be timed to permit bolls to mature before temperatures are too low for effective defoliation (or before the expected date of first killing frost if defoliation is not planned), but with sufficient moisture remaining to maintain active plants at the time of defoliation. It is impossible to specify an exact date for the final irrigation as this will vary with soil type, expected fall temperature, etc.

Fertilization. Sufficient, but not excessive, amounts of fertilizer should be provided for cotton. Adequate fertilization is needed to insure continuous plant development and top yields. Too much fertilizer, especially nitrogen, can result in rank growth, leaves which will not defoliate, late immature bolls, and a regrowth problem. Nitrogen applications made too late in the season can cause similar difficulties.

As with irrigation, it is impossible to specify a "best" rate of fertilization or a "best" time to apply fertilizer. In general, however, 50 to 200 pounds of nitrogen per acre are adequate under Arizona conditions, and applications later than July should be avoided.

Insect Control. Serious insect injury can cause defoliation problems as well as reduced yields. For example, early insect damage which knocks off the squares through June will result in a delayed fruit

Presented at the Western Cotton Production Conference, March 7-8, in Phoenix, Ariz.

set, rank growth, and delayed maturity in the fall.

Weeds. It is difficult to obtain uniform leaf coverage with defoliants on fields that are heavily infested with weeds. Also, vigorously growing weeds may not be affected by defoliating chemicals and, consequently, will interfere with machine harvest.

Temperature

Defoliants should be applied when temperatures are relatively high to obtain the best and most rapid leaf drop. Successful defoliation is very difficult to achieve when maximum daily temperatures average below 60 to 65 degrees F. Also, night temperatures below 55 degrees F. are not conducive to good defoliation.

Timing

Applying defoliant too early will result in the loss of top immature bolls, or, at least, cotton from such bolls will be inferior in quality and yield. Applying defoliant while plants are growing rapidly and have many immature leaves will result in a poor leaf drop. Applying defoliant too late may result in a poor leaf drop due to low temperatures. Applying defoliant to too large an acreage at the same time may result in serious regrowth in some fields before they can be harvested. *Timing is important.*

Maturity. In a boll that requires 50 days to progress from open bloom to open boll, 18 days are required for full development of fiber length, and 45 days are required for full development of strength, thickness, and boll weight.[1] It might be expected, therefore, that defoliation which stops development earlier than about 45 days could have deleterious effects on certain fiber properties.

At Shafter, California, investigations by Walhood[3] did indicate a critical point with regard to effect of age of boll when treated. Defoliation of plants with 41-day and older bolls caused no significant change in boll weight and seed weight, but treatment when bolls were between 32 and 41 days old caused up to 18 percent reduction. Up to 44 percent reduction in boll weight and seed weight resulted from treatment of 25- to 31-day old bolls. Under California conditions, where leaf injury usually is evident 2 to 3 days after application of a defoliant, Walhood[4] has since found that immature bolls continue to develop about 5 days following application.

In general, then, about 35 to 40 days after open bloom are required for cotton bolls to mature to the point that defoliation will cause little or no damage to yield or boll and fiber properties. The exact time will vary with temperature and other factors. The cotton should be checked. Mature bolls feel firm when pressed between thumb and forefinger, and they cannot be sliced easily with a sharp knife (the fiber strings out). If the youngest bolls are in this condition, it is safe to defoliate.

Harvest Program. Harvest facilities should be considered in deciding when to defoliate. Mature bolls open rapidly after the leaves fall. If harvest does not follow very soon, tender regrowth may become a serious problem. For this reason, defoliant applications should be staggered if harvest facilities are limited.

The final decision on when to apply a defoliant must be made by each grower considering plant condition, maturity, weather, and the harvest program.

Defoliation Rules

(1) Plan each operation carefully to obtain a uniform stand, provide adequate but not excessive irrigation and fertilization, and achieve control of insects and weeds;

(2) Check for boll maturity to be sure that yield and fiber quality are not sacrificed;

(3) Stagger defoliant applications so that cotton can be picked before regrowth is a problem; and

(4) Apply the recommended amount of material when conditions are favorable.

Coverage

Each cotton leaf must be covered with defoliant to promote a good leaf drop. When applying by air, a flagman should be used to insure complete coverage.

Multiple treatments may be necessary in rank cotton. In the West, two applications about 10 days apart of a chlorate-type defoliant have been used by many growers. In some instances, an application of chlorate-type defoliant has been followed by application of a desiccant such as pentachlorophenol.

Materials

Phosphate defoliants were used in Arizona during the 1960 season for bottom and early complete defoliation while temperatures were high. Chlorate-type defoliants were more widely used overall, however, especially during the latter part of the season. Both types of material provide satisfactory defoliation when used under the proper conditions. None of the available materials are completely satisfactory under the wide variety of conditions which exist each fall, however.

Preliminary work at the Cotton Research Center near Phoenix in 1960 indicated considerable promise for a combination defoliant-desiccant application. Very good success was obtained late in the season, but it will be necessary to repeat the work this year to determine effectiveness earlier in the harvest season.

Whatever material is used, directions for its use should be checked carefully. Generally speaking, lower rates will be required for small plants during warm weather, and higher rates will be required on large plants during cool weather.

Regrowth

As has already been mentioned, regrowth can be a serious problem if moisture and nitrogen

(*Continued on Page* 96)

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HAROLD KREAGER, Kreager Spraying Service, Kennebec, South Dakota:

"I sure like the Pawnee. The first month we used it, we sprayed 20,000 acres with it, and we had only two days that we could work all day. (In those two days we sprayed 1,750 acres one day and over 2,000 acres the other.) That is 7,000 acres more than we sprayed last year with 2 planes and 2 pilots.

"We have had many, many compliments on the plane and the job it does."

AG CHEM PEST ROUNDUP

by Kelvin Dorward

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head—Survey & Detection Operations, Plant Pest Control Division, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in U.S.D.A.'s pest surveys throughout the U. S.

Greenbugs On Buildup Throughout Oklahoma

BY the latter part of March, greenbugs were affecting small grains throughout Oklahoma. Despite widespread rains over the state during the period March 16-19, severe infestations became more common in the affected areas than in previous weeks. Greenbug damaged spots were noted in 40-50 per cent of the small grain fields checked in Love and Marshall Counties, Oklahoma. They were common in many fields in the central area of the state, and were beginning to appear in the north central area. Twenty per cent of the fields in Bryan County were reported to have been treated throughout the week ending March 24, and controls were needed in most affected sections.

Greenbug populations in the panhandle and Red River areas of Texas ranged from light to heavy. Controls were applied in many instances, but more extensive application was needed. Counts up to 2,000 per linear foot of row were found in Potter, Gray, Carson, Randall, Swisher, Oldham, and Hardeman Counties. Local, heavy populations were damaging volunteer wheat in the Denton and Wichita Falls areas. In some sections of the state, lacewings and other beneficial insects were beginning to appear.

Populations of the greenbug were relatively light in New Mexico and Kansas during March. In DeBaca County, New Mexico, the insect averaged 1-5 per linear foot in fields checked. Counts in the Tucumcari area, Quay County, average 3-28, with an occasional heavier, spotty infestation. Curry and Roosevelt Counties had much lighter counts and only an occasional speciman was found in Lea and Eddy Counties. In southeastern Kansas, counts ranged 0-100 per 100 sweeps in fields of wheat and barley.

During the early part of March the English grain aphid was the most commonly found small grain insect in 25 north central, central and southern Texas counties. In Oklahoma, the insect was common on small grain throughout the state, but counts remained fairly uniform with no particularly high populations reported.

The pea aphid continued to cause concern during March in several states. In Arizona, infestations increased on alfalfa throughout the state and populations were heavy in some areas. Heavy populations on alfalfa were reported from Dona Ana and Roosevelt Counties, New Mexico. Counts averaged 50-100 per sweep in Brazos County, Texas, on alfalfa and very heavy infestations in Denton and Wichita Falls areas were causing farmers to become concerned.

Trace to light populations of the pea aphid were found on alfalfa in the Reno-Sparks area of Washoe County, Nevada. Scarce populations were reported from eastern Sussex County, Delaware. Idaho reports that it appears likely the pest will be abundant on alfalfa again in 1961 and damage may be experienced in some southern areas of the state.

The alfalfa weevil was rather active in several states during March. Moderate to heavy populations were reported from several Georgia counties, but treated fields showed very little feeding injury. Light populations were reported from several east Tennessess counties. Washington and Unicoi counties were reported infested for the first time. Damage was reported from untreated alfalfa fields in Laurene County, South Carolina, and plans were underway to apply insecticides to Oconee County fields. In Anderson County, insecticidal controls gave varying results. Light activity of alfalfa weevil larvae was reported in Virginia, Maryland, and Delaware by the latter part of March.

Adult alfalfa weevils were active on warm days in the Arkansas River Valley of Colorado by mid-March. Controls for the weevil were applied on south and west sloping farms in a number of northern and central Utah counties. Egg laying was in progress in northwestern Nevada. Adults were active in fields of alfalfa in the Lewiston area of Nez Peree County, Idaho, but no egg laying had been noted.

The Egyptian alfalfa weevil was heavy on alfalfa on the Yuma-mesa of Yuma County, Arizona. Damage was heavy in many fields and second insecticidal applications were necessary. Light to medium infestations were present

(*Continued on Page* 86)

Control cotton seedling diseases

One application of TERRACLOR®

Terraclor and combination fungicides save cotton . . . save money

The major cotton seedling disease of Rhizoc Damping-Off or "soreshin" is effectively controlled by Terraclor soil fungicide, providing healthy, vigorous stands with the first planting. Terraclor may be combined with certain other fungicides for effective control of disease complexes. Such fungicides are Captan, Thiram, Phygon, Zineb, and Maneb.

Soil-borne fungi such as Rhizoctonia solani, Pythium and Fusarium are responsible for skips and uneven stands or even destruction of entire fields of young plants. When this occurs, replanting is necessary. This can amount to 10-25% of cotton acreage annually.

Terraclor and Terraclor combination fungicides are now accepted as a standard cultural practice in many cotton producing areas . . . proved over more than five years as the effective, profitable way to control cotton seedling diseases. For further information write to:

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. . . ELIMINATE REPLANTING

Fungicide at planting does it!

1. Eliminates skips 2. Provides better stands 3. Promotes bigger yields

Here's the damage: Every year cotton seedling diseases cost the growers an estimated $70 million . . . destroy about 3 bales for every 100 ginned, or almost 400,000 bales annually . . . cost the growers in seed, time and labor.

Here's the *TERRACLOR* profit picture:

1. Permits earlier planting with greater safety.
2. Provides vigorous, uniform stands with first planting.
3. Insures against replanting costs—saves seed, time, labor.
4. Insures against waste of valuable soil moisture by eliminating replanting.
5. Permits reduction of excessive seeding rates.
6. Develops better root systems.
7. Protects a good stand.
8. Provides healthy seedlings . . . earlier cotton.
9. Permits some boll set before cotton root rot disease attacks in certain areas.
10. Permits earlier harvest . . . and better grade of cotton if harvested before Fall rains.
11. Provides (through uniform, better stands) more efficient mechanical harvesting . . . better weed and insect control . . . more efficient use of plant nutrients and water.

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Other Crop Uses

Cabbage, Cauliflower, etc.	Club Root and Black Root or Wire Stem
Tomatoes, Peppers	Southern Blight
Beans	Root and Stem Rot, Sclerotinia White Mold
Peanuts	Southern Blight (Southern Stem Rot)
Potatoes	Scab, Rhizoctonia
Lettuce	Leaf Drop, Bottom Rot
Alfalfa, Clover	Crown Rot
Wheat Seed	Common Smut or Bunt
Garlic	White Rot
Celery*	Pink Rot, Damping-off
Onions	Smut, Sclerotium Rot
Mushrooms*	Mildew, Lipstick Mold
Strawberries*	Botrytis, Black Root, Red Stele
Ornamentals	Stem Rot, Crown Rot, Black Rot, Root Rot, Botrytis, Flower Blight
Turf	Brown Patch

TERRACLOR® is a trademark.

*Experimental use only

AG CHEM LISTENING POST

by Paul Miller

This department, which reviews current plant disease problems, is a regular feature of AGRICULTURAL CHEMICALS. The comments are based on observations of collaborators of the Epidemiology Investigations, Crops Protection Research Branch, USDA, Beltsville, Md.

Control Of Strawberry Red Stele With Soil Fungicides

R. H. Converse (1), of the Crops Research Division, Agricultural Research Service, United States Department of Agriculture, compared results obtained from a number of chemicals applied as postplanting and preplanting soil fumigants for the control of the strawberry red stele disease, caused by the soil-borne fungus *Phytophthora fragariae*. Effectiveness of the treatments was rated according to severity and percentage of infection one year after treatment.

For the postplanting treatment tests, Converse used uniformly infected plots in an established strawberry field. Disodium ethylene bisdithiocarbamate (nabam 22%; Dithane D-14) and tetramethylthiuram disulfide (thiram 75%; Tersan) were applied to the soil around the plants. Nabam reduced red stele somewhat but not enough to be of practical value. It killed about half the plants and weakened the rest. The tests did not indicate that Nabam possessed chemotherapeutic properties or had effective eradicative action. Thiram did not control red stele but was not phytotoxic.

The chemicals used in the preplanting-treatment experiments were a mixture containing 85% propargyl bromide, 31% chloropicrin, and 61% methyl bromide (Trizone); 32% sodium n-methyl dithiocarbamate (Vapam); a mixture of 98% methyl bromide and 2% chloropicrin (Dowfume MC-2); and 99% chloropicrin (Picfume). The materials were applied to soil in undisturbed rows of infected plants. Fourteen days later, strawberries were planted in beds prepared in the treated soil. All four materials reduced both severity and amount of infection. Trizone gave best control, and that by Vapam followed; both these materials greatly reduced the amount of red stele. In the chloropicrin plots strawberries planted 14 days after treatment died, and plants set one month after treatment were dwarfed and slow in growth. None of the other materials used in the preplanting tests caused injury.

Methods of Application

S. D. Van Gundy (3), of the University of California, Riverside, F. J. Foote, of the Limoneira Ranch, Santa Paula, California, and R. L. Rackman and F. J. Foote, also of the University of California, compared three different methods of applying emulsifiable 1, 2-dibromo-3-chloropropane (DBCP) in irrigation water to soil around living citrus trees for control of the citrus nematode, *Tylenchulus semipenetrans*. According to Van Gundy and his associates, application of DBCP in water is preferable to injection for perennial plants, provided nematode control is comparable. The cost of water application is usually less, a greater area can be treated, and the tree roots suffer less disturbance.

In the tests, different amounts of DBCP were applied by overhead sprinklers, by furrow irrigation, and by basin irrigation. Extent and uniformity of distribution of the chemicals at various depths in the soil were determined by measuring the growth of onion seedlings, which react to very small drops of DBCP, in soil samples taken seven days after treatment, and by counting citrus nematode larvae in samples taken four months after treatment.

Application by means of overhead sprinklers did not give satisfactory results. DBCP was uniformly distributed in the middles of the rows and in the drip lines of the trees, but none was detected in samples taken from under the trees.

In furrow irrigation the uptake and infiltration of water and consequently the distribution of DBCP were greatly affected by soil texture. The chemical was more uniformly distributed and reached greater depths in coarse-textured than in fine-textured soil. In general, furrow irrigation was considered unsatisfactory for applying DBCP.

Most uniform distribution of DBCP and most effective control of nematodes resulted from application by irrigation in basins around the trees. The use of more water than would ordinarily be applied during regular irrigation carried the chemical to greater depths in the soil. Van Gundy and his associates concluded that basin irrigation was the best of the three methods tried for applying emulsifiable DBCP in irrigation water, since it resulted in most uniform distribution of the chemical, provided treatment of the entire area

(*Continued on Page* 85)

Arcadian® News

Volume 6 | Nitrogen Division, Allied Chemical Corporation | Number 5

THE ADVANTAGES OF 20% SUPERPHOSPHATE IN MIXED FERTILIZERS

20% superphosphate is the key to the great progress which has been made in the manufacture of mixed fertilizers in this country. Manufacturers began to supply farmers with better fertilizers when industry research developed:

1. The production of 20% superphosphate by the acidulation of phosphate rock.
2. The production of nitrogen solutions for the ammoniation of 20% superphosphate to provide an economical base for mixed fertilizers.

20% superphosphate is the heart of a successful fertilizer technology which has supplied American farmers with millions of tons of efficient crop-producing power at low cost.

New gimmicks have come along for making fertilizers. New and more concentrated phosphorus carriers have been developed. But, no new method has been devised that will produce better quality fertilizers at lower cost than the technology which centers on the ammoniation of 20% superphosphate.

In the first place, 20% superphosphate has many basic advantages over other more concentrated phosphorus carriers. It is a lower cost source of phosphorus and it contains large quantities of gypsum (discussed elsewhere in this issue of ARCADIAN News).

20% superphosphate supplies phosphorus that remains in the soil available to plants over a longer period than phosphorus from more concentrated carriers which have a tendency to become fixed in the soil in compounds that cannot be used by plants.

Ammoniation of superphosphate has become the mainstay of the fertilizer industry since the creation of nitrogen solutions by Allied Chemical Corporation in 1929.

20% superphosphate will absorb more low-cost nitrogen through ammoniation with low-cost nitrogen solutions than will more concentrated phosphorus carriers. Low-cost 20% superphosphate and low-cost nitrogen solutions have enabled fertilizer manufacturers to supply farmers with low-cost, high-quality fertilizers.

Industry research with ammoniated superphosphate has helped in the improvement of the condition of all types of fertilizers and helped in the development of granular fertilizers.

As long as fertilizer manufacturers continue to make the largest possible utilization of 20% superphosphate and high levels of ammoniation, the situation favorable to the increased use of mixed fertilizers will exist and flourish.

Arcadian News for Fertilizer Manufacturers from Nitrogen Division, Allied Chemical

THE LOW COST WAY TO PUT N IN N-P-K

The most economical way to put nitrogen into mixed fertilizers is through the ammoniation of 20% superphosphate with nitrogen solutions. This tried and proven technique has been used with outstanding success by many manufacturers for many years.

Through the years, the technology of ammoniation has been constantly improved by the development of modern methods and the introduction of new types of ARCADIAN® Nitrogen Solutions. The result is more efficient production of better fertilizers.

Higher and higher levels of nitrogen take-up by superphosphate have been achieved. The standard rate at one time was 3 pounds of ammonia per unit of P_2O_5. Today it is common practice for one unit of P_2O_5 in 20% superphosphate to accommodate 5¾ to 6¾ pounds of free ammonia, without the aid of acid or the loss of nitrogen. A big tonnage of good fertilizer is being made with ARCADIAN Nitrogen Solutions supplying 1 unit of nitrogen for each 2 units of P_2O_5.

Through the use of acid, much higher rates are obtained. Some fertilizer manufacturers use this practice to produce 10-10-10 fertilizer with all the nitrogen from solutions.

High take-up of free ammonia by superphosphate is usually desirable in the manufacture of any mixed fertilizers. It is particularly desirable in the production of granular fertilizers. A high rate of ammoniation not only adds large quantities of low-cost nitrogen, it also generates heat at an opportune time in granulation.

Ask Allied Chemical

Efficient ammoniation involves proper technique, equipment and materials. There is a complete line of ARCADIAN Nitrogen Solutions from which you can make selections adapted to your particular conditions.

Nitrogen Division technical men are experts in ammoniation. Their advice is free to customers. Contact: Nitrogen Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y.

Ammoniated Superphosphate Contains Four Plant Foods

You ammoniate 20% superphosphate to put nitrogen and phosphorus in your fertilizer. But, don't forget, you also include large quantities of sulphur and calcium. In fact, 20% superphosphate contains more sulphur and more calcium than phosphorus.

Other more concentrated sources of phosphorus, such as triple superphosphate and ammonium phosphate, are deficient in calcium and sulphur because the gypsum has been removed.

It will pay you to tell farmers about the two bonus plant foods they get in your mixed fertilizers made with 20% superphosphate. For every unit of phosphorus in 20% superphosphate, you give the farmer 137 pounds of gypsum (calcium sulphate).

Both the calcium and the sulphur in gypsum are valuable plant foods. In addition, gypsum is an excellent soil conditioner, widely used to improve water penetration in tight soils. Farmers use hundreds of thousands of tons of gypsum each year in addition to the gypsum they get in superphosphate.

You charge your customers for the nitrogen, phosphoric acid and potash in your mixed fertilizer. When you use ammoniated superphosphate, you also give them calcium, sulphur and a soil conditioner at no extra cost except for transportation.

The value of calcium in fertilizer is well known. Calcium is an essential plant food. It also helps to counteract the effect of low pH. Many crops grow well at a low pH when they have an adequate supply of calcium from gypsum.

The value of sulphur in fertilizer is demonstrated by the fact that crops, on the average, remove about as much sulphur from the soil as they do phosphorus. Yet the average soil contains only half as much sulphur as phosphorus.

With the increase in the use of sulphur-deficient triple superphosphate and ammonium phosphate in concentrated fertilizers, much land gets little sulphur. The lack of this secondary plant food element is more and more apt to limit crop yields and profits.

Critical Sulphur Shortage

The shortage of sulphur is becoming critical for many crops on many soils. Cotton, corn, tobacco, legumes, grass, onions and cabbage are heavy users of sulphur. Field tests in many areas now show definite response of crops to additional sulphur.

Symptoms of sulphur deficiency appear in corn and other crops as pale green leaves, not to be confused with the drying up of older, lower leaves, typical in nitrogen deficiency. Sulphur is needed to produce the essential amino acids that go into making the protein of plant cells.

Sulphur is required for good nodule formation on legume roots. With cotton, lack of sulphur reduces number of bolls matured, rate of growth and yield of seed cotton. On an elemental basis, the

Cotton is a heavy user of sulphur. So are corn, legumes, onions and cabbage. Many soils are running out of sulphur fast!

corn plant actually uses as much sulphur as it does phosphorus. A 100-bushel crop requires 160 pounds of nitrogen, 25 pounds of elemental phosphorus, 100 pounds of potassium, and 25 pounds of sulphur.

Sulphur leaches out of the soil almost as fast as potash or calcium, and it needs to be applied frequently. In the past, sulphur requirements of plants have been largely ignored because most fertilizers have carried substantial amounts of sulphur along with nitrogen, phosphorus and potash.

All of the available evidence builds up an impressive case for continuing to supply sulphur in mixed fertilizers. When you ammoniate superphosphate for your mixed fertilizers, you are giving farmers a bargain in free sulphur, calcium and soil conditioner. You and your dealers will benefit by telling farmers about these bonus values.

PLEASE DO NOT HOLD TANK CARS TOO LONG

Nitrogen Division, Allied Chemical Corporation, is doing its utmost to keep its delivery facilities operating at top efficiency during this period of peak demand for nitrogen. Extra effort is being exerted to keep tank cars rolling to your plant to supply you with ARCADIAN® Nitrogen Solutions when you want them.

The only thing that can interfere with this service is a shortage of tank cars. Despite the fact that Nitrogen Division is operating more tank cars than ever before, if too many fertilizer manufacturers hold too many tank cars too long, a shortage may cause slow deliveries.

You can cooperate by returning empty tank cars as quickly as possible. A tank car sitting idle on your siding—or anyone else's—can't also be back at the nitrogen plant taking on that rush order you just placed. So unload tank cars as fast as you can and return them.

You cannot mix and ship tonnage on schedule if you are waiting for nitrogen solutions. And Nitrogen Division, Allied Chemical Corporation, cannot ship solutions on schedule if tank cars are not available. Don't hold tank cars! Keep 'em rolling to serve you!

Complete Fertilizer Service Builds Exclusive Customers

Everyone who sells fertilizers wants plenty of exclusive customers. The best way to build customer loyalty is to be prepared to supply all of the mixed goods analyses and straight materials the farmer needs and wants. You are in danger of losing a customer when you provide only part of his plant food needs and force him to go elsewhere to buy what you do not sell.

You can't help but benefit when your customers make you their headquarters for all their fertilizer requirements. It pays to establish your prestige and your leadership as a dependable, one-stop, full-line source of supply.

You will find it profitable to study market trends so that you can anticipate demands and be prepared to supply these demands. Three important trends are now evident in fertilizer consumption figures: **1.** The growth in the use of high-nitrogen fertilizers. **2.** The fact that more nitrogen is sold as straight materials than in mixed fertilizers. **3.** The rapid increase in the use of nitrogen solutions for direct application.

Experiment Stations are recommending more and more nitrogen for crops. Corn and several other major crops require more nitrogen than any other plant food. More and more farmers are testing their soils and they know their needs.

For many crops and soils, farmers have found that it pays to use more than one application of nitrogen. They apply part of their nitrogen in mixed fertilizers and part of it in one or more separate applications of straight material.

Sell straight nitrogen materials along with your mixed fertilizers and you increase your sales and your profits. There was a time when straight nitrogen materials did not offer an attractive profit margin to fertilizer manufacturers. But the situation is different today, particularly in the case of ARCADIAN® Nitrogen Solutions for direct application.

Some fertilizer manufacturers are finding that they make bigger profits from ARCADIAN Golden URAN®, ARCADIAN FERAN® and ARCADIAN NITRANA® than they make from mixed fertilizers.

When you sell ARCADIAN nitrogen materials (liquid and dry) for direct application, you help farmers to get better yields and insure that response to your mixed fertilizers will not be limited by lack of nitrogen. You sell a bigger tonnage of plant food and you build farmers into exclusive customers for you and your dealers.

You will find it profitable to let Nitrogen Division, Allied Chemical, work with you in helping you to offer your customers a complete line of mixed fertilizers and straight nitrogen materials.

Many different ARCADIAN Nitrogen Solutions are available for the manufacture of every mixed fertilizer analysis now in demand. Many different ARCADIAN Nitrogen Products (liquid and dry) are also available to sell to farmers for direct application.

Start now to make ARCADIAN Nitrogen a sales builder for you. Contact: Nitrogen Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y. Phone: HAnover 2-7300.

Arcadian® NITROGEN SOLUTIONS

	CHEMICAL COMPOSITION %						PHYSICAL PROPERTIES		
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60°F	Approx. Vap. Press. at 104°F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®									
2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
URANA®									
6C	43.0	20.0	68.0	6.0	6.0	9.3	1.180	12	39
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	- 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
DURANA®									
DURANA contains 8% formaldehyde.	37.0	13.3	53.4	15.9	9.4	7.2	1.235	0	36
U-A-S®									
A	45.4	36.8	—	32.5	30.7	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	13.5	0.978	48	46
[illegible]	82.2	99.9	—	—	—	24.3	0.618	211	-108

Other ARCADIAN® Products: URAN® and FERAN® Solutions • Ammonia Liquor • N-dure® A-N-L® • Ammonium Nitrate • UREA 45 • Nitrate of Soda • Sulphate of Ammonia

When you purchase your nitrogen requirements from Nitrogen Division, Allied Chemical, you have many different nitrogen solutions from which to select those best suited to your ammoniation methods and equipment. You are served by America's leading producer of the most complete line of nitrogen products on the market. You get formulation assistance and technical help on manufacturing problems from the Nitrogen Division technical service staff. You benefit from millions of tons of nitrogen experience and the enterprising research that originated and developed nitrogen solutions.

NITROGEN DIVISION

Allied Chemical

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NEWS ABOUT THE AG CHEM TRADE

ASA Executive Secretary

Dr. Matthias Stelly, formerly professor of soils at Louisiana State University, has been named executive secretary of the American Society of Agronomy, Madison, Wis. Dr. Stelly succeeds L. G. Monthey, who had served as ASA executive secretary since January 1948 and who now is an extension resource development specialist with the University of Wisconsin. Dr. Stelly taught soils at the University of Georgia from 1946 to 1957. In 1952-53, he worked in Kenya, East Africa, as a soil specialist with the British Colonial Office. In 1957, Dr. Stelly joined the staff at Louisiana State University as head of soil testing and then as professor of soils specializing in teaching and research in soil chemistry.

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John H. Kennedy Retires

John H. Kennedy, a pioneer in the agricultural chemicals business, is retiring this month from his position as assistant to the vice president, Agricultural Chemicals Division, Stauffer Chemical Co.

Mr. Kennedy has spent more than 45 years in industrial and agricultural chemical sales. He was Stauffer's eastern sales manager for agricultural chemicals for 20 years. He also has served on the board of directors of the National Agricultural Chemicals Association.

On retirement, Mr. Kennedy plans to "actively relax" as resident manager of Zipse's East Lake Fishing Camp, Oakland, Me. The camp is owned by Bob Zipse, former Olin Mathieson sales manager.

•

Trona Prices Raised

An increase of three cents per unit of K_2O for agricultural grades of American Potash & Chemical Corp. muriate and sulfate of potash will become effective July 1.

The new prices for Trona muriate of potash will range from 44 cents to 48½ cents per unit of K_2O, depending upon time of delivery. Prices for Trona sulfate of potash will range from 76 cents to 84 cents per unit of K_2O.

•

Heads Western States Chem.

R. H. McGough has been appointed president of Western States Chemical Corp., Los Angeles. He had been general manager of agricultural chemical sales for Collier Carbon and Chemical Corp.

John A. Foster has been named by Collier to succeed Mr. McGough.

•

Manns Joins Great Lakes

Marshall M. Manns has joined the Great Lakes Chemical Corp., Los Angeles, Calif., as manager of agricultural chemical sales. He is stationed at the company's Kansas City, Mo., office.

Prior to joining Great Lakes, Mr. Manns' sales activity had been Gough.
focused on the various uses of methyl bromide mixtures for control of insects in stored grain.

Products newly added to the Great Lakes line include GL37 and GL73, which are combinations of fumigants incorporating varying percentages of ethylene dibromide and methyl bromide.

•

Grace Expands Facilities

A 6,000-square-foot New Product Development building has been erected at W. R. Grace & Co.'s central research facility in Clarksville, Maryland, to handle the expanded activities of the New Products Development and Agricultural Chemicals Research departments.

Radden Joins Foxboro

Charles O. Radden has been named to the newly-formed marketing division of The Foxboro Co., Foxboro, Mass. He is in charge of chemical industry promotion, both for the United States and the international markets.

Prior to joining Foxboro, Mr. Radden had been with the nuclear marketing section of United Shoe Machinery Corp. His previous experience includes positions with E. I. du Pont de Nemours & Co., Wilmington, Del., Monsanto Chemical Co., Everett, Mass., and Arthur D. Little Co., Cambridge, Mass.

•

Co-op Buys Fertilizer Plant

Mississippi Federated Cooperatives, Jackson, Miss., has purchased a fertilizer plant at Hattiesburg, Miss. The co-op will spend about $200,000 to modernize the plant and will manufacture pelleted lime-base fertilizer.

•

To Spend $30 Million

Texas Gulf Sulphur Co., New York, plans to spend $30,000,000 on its new potash mining and processing plant now being constructed in southeastern Utah, near the town of Moab. The plant is designed to produce at the outset 1,100,000 tons of potash annually. Construction has begun on the mine shaft, and the plant is scheduled to begin operations by the end of 1962.

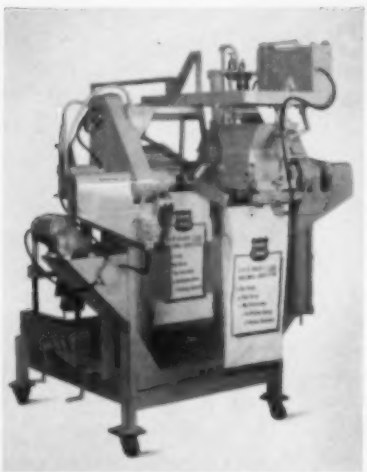
Texas Gulf has awarded to Harrison International, Miami, Fla., the shaft-sinking and underground construction contract for development of the potash beds. A contract for building a milling plant and other surface facilities previously was awarded to Sterns-Rogers Mfg. Co.

Why are more and more feed packers using Union-Camp I&C bagging equipment?

Over 1000 Union-Camp I&C installations have been made in the last six years. Here are 8 reasons behind their astonishing popularity.

1. Reduced Packaging Costs. I&C's pay for themselves. Their fast, *automatic* operation reduces packaging and labor costs, increases profitability. Dozens of repeat orders attest to their efficiency and economy.

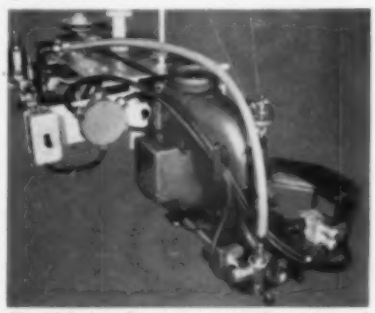
2. 20-a-Minute—and More. The Union-Camp I&C Bagger was the first machine to introduce high-speed filling of open-mouth multiwall bags. Speeds well in excess of 20 bags per minute can be sustained, depending on the flow of the product.



I&C Automatic Bag Hanger speeds bagging operation by automatically supplying empty SOM multiwalls to bag-filling machine.

3. Outstanding Flexibility. With the versatile I&C, you can make weight changes from 25 to 200 lbs.—with just a turn of a scale dial knob! No bag clamp is necessary.

4. Accurate. The I&C *automatically* pre-weighs the net amount of material before it is dumped in the bag. At speeds of 20 bags a minute and more, weight variation is within *plus or minus 2 ounces* on 100 lb. packages of uniform granular or pelletized products.



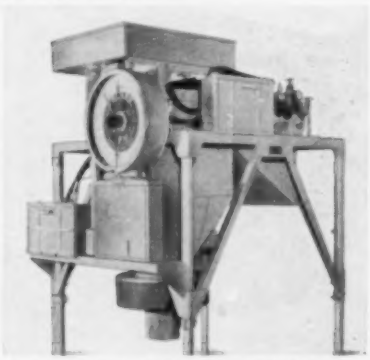
The I&C Acto-Cutter automatically starts and stops sewing action and cuts threads between bags. An outstanding time and labor saver.

5. Low Maintenance. Simplicity of design is a major feature of I&C equipment. Another is sturdy construction. Many packers report low maintenance cost a key factor in their selection and repurchase of I&C bagging equipment.

6. Cuts Production Time—Speeds Service. With the I&C you can bag and ship required tonnages faster. There is usually little or no downtime. Thus you speed customer service and delivery, reduce costly overtime.

7. Labor-Saving Accessories. There is a wide range of machine models plus many cost-cutting auxiliaries. These include sewing machine lubrication systems, dual head sewing stand, automatic actuators and thread chain cutters—everything you need to streamline your multiwall bagging operation.

8. Valuable Survey Service. Union-Camp package machinery specialists make comprehensive surveys of your plant. They make up exact machinery and installation specifications and layouts. They train operating personnel, help determine the actual savings for your operation. All at no cost or obligation.



Newest I&C Bagger—the UB-101. Machine's features include dial scale which provides for instantaneous weight changeovers from 25 to 200 lbs. with a turn of a knob.

FREE BOOKLETS

Get the complete story of the profit opportunities I&C equipment offers you. We'll be glad to send you free booklets illustrating and describing our complete line of machine models and accessories. Write Dept. A-1 today, or contact your nearest Union Bag-Camp Paper multiwall representative.

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Esterhazy Potash Mine Shaft Lining Is Completed

The cone-shaped structures are huge storage buildings at the Esterhazy potash mine. Tall structure in center cluster of buildings is headframe over the mine shaft.

A 3,000-ton cast-iron lining which walls off the 200-foot Blarimore stratum of the International Minerals and Chemical Corp. (Canada) Ltd. potash mine shaft 12 miles north of Esterhazy, Saskatchewan, has been completed. The lining is 350 feet long and is made up of 76 iron rings.

The lining is expected to end the problem of water seepage that has stymied the development of the potash reserve. The Blairmore stratum is a geological stratum that carries oil in some areas, coal in others, and water under extremely high pressures in others. It is composed of water-bearing sand and clay layers where it occurs between the 1,240 and 1,439 foot levels at Saskatchewan. The shaft was sunk through the stratum by Associated Mining Construction Ltd., a group of four German shaft-sinking companies.

The potash beds are located at 3,150 feet and limestone formations in the last 1,600 feet are expected to present no unusual problems. Initial production is expected during the fiscal year ending June 30, 1962.

A pilot surface plant for initial production already is virtually completed and can handle about 420,000 tons of product annually. This capacity will be more than doubled by a planned addition, construction of which is expected to be scheduled this summer.

Cotton Responds To Potash

When potash fertilizers were applied, cotton yields increased significantly in some fields of California's San Joaquin Valley, L. K. Stromberg, Fresno County Farm Advisor, told the 1961 Potash Review Meeting in Fresno last month. The meeting was sponsored by the American Potash and Chemical Corp.

Potash deficiency symptoms—which include premature wilting of leaves, becoming thick, leathery, and brittle and eventually dying and falling off the plants — were observed when plants were about 120 days old, Mr. Stromberg reported. Cotton plants adequately supplied with potash, he said, are soft and should feel like suede.

When fertilizer containing 245 pounds of potash per acre was applied to experimental plots in 1959, he said, potash deficiencies cleared up and yields of lint cotton increased an average of 207 pounds per acre. "It was interesting to note," he continued, "that plots receiving fertilizer containing 245 pounds of potash per acre in 1959 and an additional 250 pounds in 1960 yielded 106 pounds more lint per acre than plots receiving only the 250 pounds of potash in 1960."

•

USDA OK's Butonate Label

Butonate, an insecticide developed by the Wisconsin Alumni Research Foundation, has been approved by the U. S. Department of Agriculture for use in aerosol, space, and direct sprays against household insects. A license to manufacture and distribute Butonate previously had been granted by Wisconsin Alumni to Prentiss Drug and Chemical Co., New York.

In addition to its use as a household insecticide, a number of other applications for Butonate are being investigated in the field, particularly for the control of insects affecting livestock.

Chemically, Butonate is o,o-dimethyl 2,2,2-trichloro-1-n-butyryl-oxyethyl phosphonate. It is a cholinesterase inhibitor. As previously reported in *Agricultural Chemicals* (June, 1960, page 90B), Butonate has been tested against adult pea aphids, against the larvae of the southern army worm and Mexican bean beetle, and against *Tetramychus atlanticus mites*. It may be formulated as an oil spray, an emulsion, wettable powder, or dust.

•

Symposium On Residues

A symposium on the analysis, degradation, and metabolism of pesticide residues has been arranged as Section C3 of the Analytical Chemistry program of the 18th International Congress of Pure and Applied Chemistry, to be held in Montreal, Canada, August 6 to 12. The symposium will be held August 7, 8, and 9.

Among the speakers will be Dr. R. D. O'Brien, Cornell University, Ithaca, New York, "Molecular configuration and activity of pesticides as related to degradation and metabolism," F. P. W. Winteringham, Pest Infestation Laboratory, Slough, U. K., "Tracer techniques for determination of the chemical fate of insecticides," Dr. S. Dormal, Centre de Recherches de Phytopharmacie, Gembloux, Belgium, "Comparative methods of residue analysis," and Dr. W. E. Westlake, USDA, Beltsville, Md., "Objectives and progress in regional pesticide residue projects in the U. S."

Twenty-four other papers and contributions are to be presented by speakers from the United States, France, England, Italy, Yugoslavia, and Canada.

•

Stauffer Buys Alcoa Unit

Stauffer Chemical Co., New York, has purchased the flourides-producing facilities of the Aluminum Company of America at East St. Louis, Ill.

Unique Toxaphene Informational Program Stimulates Interest in Proper Insecticide Use...

This season, as in the past, Hercules Powder Company will promote an informational program designed to create an awareness of the need for better insect pest control. One of the highlights of the 1961 program is a four-page, four-color insert running in leading Cotton Belt publications, outlining a planned, complete program of cotton insect control with toxaphene-DDT, the insecticide combination with "synergistic action."

Toxaphene promotion with seasonal messages will also appear in local farm publications, newspapers, and on local radio and TV stations and other media. Hercules will also continue its long-time sponsorship of leading radio and TV farm directors in the Cotton Belt and in other prime toxaphene markets.

Millions of farmers will have a new interest in toxaphene and the toxaphene-DDT combination. The Hercules informational program will help them get the most from their insecticide dollar —build more confidence in insecticides.

A copy of the special Cotton Belt insert "Higher Yields, Quality Cotton, More Profit" is available on request. Write to:

TOXAPHENE

Agricultural Chemicals Division
HERCULES POWDER COMPANY
Hercules Tower, 910 Market Street
Wilmington 99, Delaware

NX61-3

Louis Ware Scholarship Winners For 1960-61

The first recipients of $1,000 senior-year scholarships awarded by International Minerals & Chemical Corporation under a new program at 12 leading colleges are shown at IMC's headquarters in Skokie, Ill. The scholarships — six in minerals sciences and six in agricultural sciences—are named for Louis Ware, IMC board chairman. Left to right, seated: Martin D. Merz, Stanford; Wayne M. Brooks, North Carolina State; William N. Seery, Colorado School of mines; Melvin M. Mathias, Purdue; and Steven W. Clark, Minnesota. Left to right, standing: George A. Ekstrom, Cornell; Joseph C. Conway, Pennsylvania State; Leroy J. Hushak, Iowa State; Terry N. Turner, Missouri School of Mines; Guy R. Honold, Wisconsin; Richard W. White, Michigan College of Mining and Technology; Thomas M. Ware, President of IMC; and Charles D. Kesner, Michigan State College, East Lansing, Mich.

Moshe Novomeysky Dies

Moshe A. Novomeysky, who tapped the potash deposits of the Dead Sea, died recently in Paris. He was 88 years old.

Mr. Novomeysky was head of the Dead Sea Works Ltd., which extracts more than 100,000 tons a year of potash and other minerals from the Dead Sea. Born in Russia, Mr. Novomeysky went to Palestine in 1911 and began surveys and experiments that turned the waters into an asset. With the support of Israel B. Brody of New York, he raised $2,000,000 to start the Palestine Potash Company, with its extraction plant on the shores of the Dead Sea. The plant was destroyed during fighting between Israel and her Arab neighbors during 1948. A new plant has since been built in Israeli territory as the Dead Sea Works Ltd.

•

Warehouse Contract Awarded

California Chemical Co., San Francisco, has awarded contracts for the construction of warehouse facilities at the complex fertilizer plant now under construction for the Ortho Division of California Chemical Co. in Fort Madison, Iowa. The general contractors on the job will be the Priester Construction Co., Davenport, Iowa, and W. A. Klinger of Sioux City.

The complex fertilizer warehouse is to be the largest bulk operating warehouse in the U. S. when finished. It will have a capacity of 70,000 tons of complex fertilizer.

•

XVIth International Congress

The XVIth International Horticultural Congress will be held in Brussels, Belgium, from August 31 to September 8, 1962. The congress is being organized under the auspices of the International Society for Horticultural Science.

•

Potash Expansion Continues

Pittsburgh Plate Glass Co. and Armour & Co. have announced plans for a joint venture in solution mining of potash. The new partners last month disclosed plans for a $1 million experimental solution drilling unit in the Canadian potash fields. Drilling of test wells already has started on a property 18 miles east of Moosejaw, Saskatchewan, to tap deposits underlying that area.

In solution mining—an innovation for potash—water is pumped into the mineral deposit, the mineral is dissolved in the water, and then is recovered above ground from the solution. Pittsburgh Plate's chemical division has for a number of years mined sodium chloride at depths as great as 6,800 feet by the solution method.

•

CSMA To Discuss Pesticides

E. F. Mace, S. C. Johnson and Son, Inc., Racine, Wisc., will discuss house and garden aerosols in a symposium on aerosol insecticides to be held by the Insecticide Division of the Chemical Specialties Manufacturers Association at the association's annual meeting in Chicago, May 16 and 17. The meeting will be held in the Drake Hotel.

Also on the program are; John Odeneal, Fairfield Chemicals Division, Food Machinery and Chemical Corp., New York, "Space Formulations — Up to Date", and J. E. Bussart, Velsicol Chemical Corp., Chicago, "Residual Formulations — Up to Date."

Dr. H. L. Haller, Agricultural Research Service, USDA, will present his personal observations on pest control in Russia and other European countries and Dr. George C. Decker, Illinois Natural History Survey, Urbana, will present a paper on problems in the control of face flies.

•

Shell Plans Sulfur Plant

A gas processing and sulfur plant will be constructed by Shell Oil Co., New York, in the Bryans Mill gas field in Cass County, Texas. Scheduled to be in operation by the end of this year, the unit will extract hydrogen sulfide from gas and convert it into elemental sulfur.

•

Atlas Plans Name Change

Atlas Powder Co., Wilmington, Del., plans to change its corporate name to Atlas Chemical Industries, Inc., upon completion of its merger with Stuart Co., a Pasadena, Calif., ethical drug maker.

Research Support Urged

Federal support for agricultural research will not be provided in anything like the amount required unless entirely new action is taken, Wm. Rhea Blake, executive vice president of the National Cotton Council, told the National Peanut Council's annual convention April 10 in Washington, D. C.

He urged action to inspire confidence in what agricultural research can do, to concentrate attention on the big and important problems of farmers, to work realistically toward expanded markets, to promote the effectiveness of agricultural research, and to command the respect of congress. Mr. Blake pointed out that a bill aimed at achieving these objectives passed the House last year and has been re-introduced. It is authored by Representative Abernethy of Mississippi.

"We have three big problems in agricultural research," he explained. "The first is that we don't have enough, the second is the threat of a tragic misdirection of research, and the third is our need to be certain that our entire research effort is just as effective as it possibly can be."

•

Fertilizer Short Course

A short course on fertilizer technology will be held at Purdue University, Lafayette, Indiana, Feb. 12 and 13, 1962, under the sponsorship of the Soil Science Society of America. Chairman of the committee arranging for the short course is Dr. Malcolm H. McVickar, Ortho Division, California Chemical Co.

The short course will immediately precede the annual Joint Meeting of Midwestern Agronomists and Fertilizer Industry Representatives at the Edgewater Beach Hotel, Chicago, Feb. 15 and 16.

•

Plan More Pyrethrum

Plans for increasing pyrethrum production in Kenya to 14,000 tons per year were announced recently by Norman Hardy, executive officer of the Kenya Pyrethrum Board and administrator of the African Pyrethrum Technical Information Centre Ltd. He said that more than 20,000 African families and 1,050 European farmers are now producing pyrethrum in Kenya.

•

WACA Meeting Oct. 9 to 11

The 1961 annual meeting of the Western Agricultural Chemicals Association will be held in the Hotel Claremont, Berekeley, Calif.

R&H Microbial Insecticide

Rohm & Haas Co., Philadelphia, is offering a microbial insecticide tradenamed "Bakthane" for the control of such agricultural pests as the cabbage looper, imported cabbage worms, tobacco hornworm, and tobacco budworm. The active ingredient in Bakthane is *Bacillus thuringiensis* Berliner, in the form of viable spores. Bakthane may be applied as a spray, dust, or bait.

To Use Elemental Method

The elemental method of expressing fertilizer nutrients, including minor elements, will be used in the research and educational journals of the Soil Science Society of America and the American Society of Agronomy, beginning with the January 1962 issues.

Contributors to the journals, however, will be permitted to include the oxide expressions such as P_2O_5 and K_2O along with the elemental analyses. The society publications include the research journals *SSSA Proceedings* and *Agronomy Journal* and the magazine *Crops & Soils*.

•

Arizona Co. Advances Two

Ted W. Swift, formerly executive assistant in charge of production for Arizona Fertilizer and Chemical Co., Phoenix, has been named vice president of the company. He joined the firm in 1938. At the same time, the company announced the appointment of Joseph G. Hartsig as assistant vice president. He had been executive assistant in charge of purchasing and product development.

•

Sees More Nitrogen Use

Haven Leavitt, Snell Development Co., Modesto, Calif., projected nitrogen's future in California agriculture at the 9th annual California Fertilizer Conference, held on the Kellogg-Voorhis campus of California State Polytechnic College, Pomona, March 27 and 28. He reported a steady and rapid increase in the use of nitrogen in California between 1940, when 31,820 tons were applied, and 1959, when 260,270 tons of nitrogen were applied.

The development of improved placement of fertilizers, he said, is enhancing the efficiency of nitrogen utilization. Mr. Leavitt predicted an ever-increasing tonnage of nitrogen in California.

Seek Credit To Build

A syndicate formed by eight Japanese manufacturing firms is negotiating with the Japanese government for a credit of 20 to 25 million U. S. dollars to finance the construction of a fertilizer plant for India. The syndicate reportedly has made a bid to build the $50 million fertilizer plant which would be located in Uttar Pradesh State. The plant would have an annual production capacity of 1,400,000 tons of urea.

•

U.S. Borax Names McCloskey

Dr. A. L. McCloskey has been appointed to the newly-created position of associate director of market development and technical service of United States Borax & Chemical Corp., Los Angeles.

He had been associate director of chemical research for U.S. Borax Research Corp. at Anaheim, Calif. In his new post, he is located at the company's New York office.

CONTROL RUSSIAN KNAPWEED

WITH OLDBURY® SODIUM CHLORATE

When herbicides are used, Oldbury sodium chlorate is still the most effective weed killer you can get for such troublemakers as Russian knapweed, Johnson grass, Canada thistle, and bindweed.

Oldbury sodium chlorate sterilizes the soil . . . reaches right down to the roots of the weed . . . and keeps working for months.

Oldbury sodium chlorate is inexpensive. For a mere 25¢, you can sterilize 100 square feet of drainage ditch, fence line, or roadway for a year or longer.

Open-head drum empties easily. Oldbury sodium chlorate comes in a fast-opening drum. A single lever seals and reseals the drum with a metal band. Full-open head makes pouring, scooping, or shoveling easy.

Available in 50-, 100-, and 450-lb. sizes.

Technical aid. Full-time Hooker agronomists can help with weed control plans and advise on handling, storing, and using sodium chlorate. Write for descriptive folder.

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KENNEDY Air Swept Grinding and Pneumatic Conveying Systems are important components of this, the first, triple super-phosphate plant in Mexico. This plant was designed and equipped by Dorr-Oliver for Guanos y Fertilizantes.

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KENNEDY Ball Mills are noted for high tonnage and low cost processing of phosphate rock and other agricultural chemicals:

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- No periodic shut downs for wearing part replacement
- Grinding media is replaced without interruption
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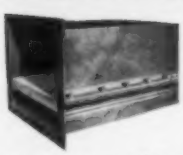
- Careful basic design and pressure lubrication assure high mechanical efficiency
- Reliable feed control and overall reliability provide high production with minimum manpower
- Higher capacity in single units—less space and structural steel per ton of capacity and lower initial investment.



KENNEDY AIR-FLOAT Conveyors provide trouble-free air-gravity conveying of dry materials:

- There are no moving parts—nothing to wear—nothing to maintain
- Only small volumes of low pressure air are needed—uses less power
- Operates quietly—has high capacity—requires little headroom
- The conveyed materials are completely enclosed—there is no dust
- Permits flexible design—directional changes are simple
- Can be made from corrosion resistant alloys
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Consult KENNEDY for further details. Let us show you the many advantages KENNEDY equipment can offer you.

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Fertilizer Producers See 10% Rise in Sales

FERTILIZER manufacturing officials are reported in a *Wall Street Journal* "News Roundup" to be optimistic about the prospects for sales during the current fertilizer season. According to one official, sales are excellent. During March, sales reportedly were well ahead of last year in every region of the country but the East, where the weather was wet.

Other reasons listed for the increased demand for fertilizer include the rapid expansion in population, the search for better foods and for more production per acre, and the increased income realized by farmers during 1960. Estimates place the 1961 gain in sales as high as 10 per cent over last year's sales of $1,220,000,000. It is believed that the industry will be prevented from going higher than a 10 per cent gain because at that level it will be operating close to full capacity.

On the other side of the picture, however, there are fears that there may not be enough trucks and freight cars available to haul the heavy tonnages expected during the current peak period when almost two-thirds of the close to 27 million tons of fertilizer expected to be sold this year is being shipped. Producers also have expressed concern about imports of foreign-made fertilizer. At ports such as New Orleans, incoming foreign shipments have affected regional prices. On the whole, however, prices are firm. An example is phosphoric acid, currently selling for about $75 per ton.

Rutgers Names Merrill

Dr. Leland G. Merrill Jr., Rutgers research specialist in entomology, last month was named dean of the College of Agriculture, Rutgers University, New Brunswick, N.J., and director of the Agricultural Experiment Station of the university. Dr. Merrill succeeds Dr. William H. Martin, emeritus dean of the college of agriculture, who retired last June.

Dr. Merrill's first Rutgers appointment was as a research assistant in entomology in 1946. He received a master's degree from Rutgers in 1948 and his Ph.D. degree the following year. He was an assistant professor of entomology at Michigan State from 1949 to 1953. He rejoined the Rutgers faculty in September, 1953.

•

D-O Transfers Harrison

Harry Harrison has been transfered from the engineering department of Dorr-Oliver Inc., Stamford, Conn., to the company's pump sales division as application engineer. In this position, he provides technical assistance to the fourteen distributors of Dorr-Oliver pumps in the U.S., and to their customers.

Critics Termed Uninformed

Herbert Woodbury, president of Midwest Agricultural Chemicals Association, termed as "uninformed" the various groups who decry the use of agricultural chemicals. Speaking before a recent meeting of the Nebraska Grain and Feed Dealers Association at Omaha, he identified these groups as "organic farmers wild life supporters, and Audubon organizations."

"Obviously," Mr. Woodbury said, "if all efforts to control pests were abandoned in this country, agricultural lands soon would revert to the conditions that prevailed prior to the coming of the white man, capable of supporting only about one million persons. What would happen to the rest of us?"

•

To Build Ammonia Plant

W. R. Grace & Co., New York, plans to build an ammonia plant in Big Springs, Texas. The plant is expected to be producing early next year and is designed to produce in excess of 60,000 tons of ammonia annually. Foster Wheeler Corp., New York, will design and construct the plant.

The new plant will adjoin the Big Spring oil refinery of Cosden Petroleum Corp. and will be operated for Grace by Cosden. Grace owns 53 per cent of the outstanding stock of Cosden.

•

Correction

Our report of the W.A.C.A. spring meeting, starting on page 16 of the April issue, quoted P. J. Reno of Hercules Powder Co. as saying that only 75 pounds of cotton linters per acre are produced in Egypt. What Mr. Reno actually said is that only 75 pounds of lint cotton per acre are produced in *India*, compared with more than 400 pounds in the U. S.

Actually, Egypt will average higher per acre yields than the U. S. when growing cotton of comparable variety.

Niagara Opens New Plant

A pesticide formulating plant at Dothan, Alabama has been established by Niagara Chemical Division of Food Machinery & Chemical Corp., Middleport, N. Y. The new unit will produce insecticide and fungicide formulations.

James M. Swilly, formerly a foreman at Niagara's Jacksonville, Fla., plant, is production manager at the new plant, which is located in an existing 16,000 square foot building on Alabama Highway 53.

•

Beddoe Joins Great Western

Paul Beddoe has joined the agricultural chemical department of Great Western Chemical Co., Portland, Oregon. He is located in Medford, Oregon, where Great Western has a warehouse and office for distribution of agricultural chemicals in the southern Oregon and northern California area.

Mr. Beddoe formerly was with Bear Creek Orchards in Medford, Oregon.

COMPATIBLE
WITH ALL COMMONLY USED TOXICANTS

PYRAX® ABB

PYRAX ABB is the best known and most widely used agricultural diluent. It offers maximum compatibility with most toxicants.

It has been used with rotenone since agricultural dusting was in its infancy. It is now used equally well with the newest organic toxicants.

PYRAX ABB is pyrophyllite. It is chemically inert, has low moisture content and neutral pH. Little or no stabilizer is needed. When you dilute your toxicants with PYRAX ABB, you achieve easier handling, better coverage and simpler formulation.

You can order PYRAX ABB and PYRAX Granules for shipment in mixed carloads or truckloads.

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Please send Bulletin 19D "Compatibility of Vanderbilt Diluents with Agricultural Toxicants"

State Application .....

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(Please attach coupon to your Company letterhead) P-20

Increased Fertilizer Exports Predicted For 1961

PROSPECTS for an increase in U. S. exports of fertilizers in 1961 are favorable, according to the Business and Defense Services Administration of the U. S. Department of Commerce. Because of the adverse international balance of payments situation, the International Cooperation Administration has been directed to restrict purchases of commodities abroad with its fund, a development that may result in more fertilizers being procured in the United States for aid programs in Korea and other countries. Formerly, foreign suppliers have underbid the U. S. industry for much of the ICA fertilizer business.

World supplies of potash, which became tight during the last half of 1960, may lag behind demand in 1961. A slowdown strike in French mines, although now settled, curtailed exports from that country, and in Spain a mechanical breakdown has reduced potash supplies. Consequently, the U. S. potash industry may be faced in 1961 with a combined domestic and foreign demand for potash that will exceed supplies. Difficulties encountered by potential Canadian producers in sinking mine shafts have delayed the availability of potash from that source. However, production in Saskatchewan is expected to be underway by late 1961 or early 1962.

The immediate outlook for world nitrogen is for increased capacity and sharper competition. World production and consumption of fertilizer nitrogen during the 1958-59 fertilizer year are estimated by the Food and Agriculture Organization of the United Nations at 8,750,000 and 8,000,000 metric tons N, respectively. Although nitrogen sales in the Common Market area were up in 1959-60, European sources indicate that there was considerable price cutting and loss in earnings by producers. Relief from the surplus does not appear imminent inasmuch as capacity is projected through 1965 at an annual rate of increase of 880,000 tons N, and consumption growth at 800,000 tons.

In the United States, total 1960 production of nitrogen (synthetic and byproduct for fertilizer and industry) of approximately 4,200,000 tons N is estimated to have exceeded 90 per cent of capacity. In recent months, however, plans have been announced for 7 new synthetic ammonia plants. These new projects will total approximately 500,000 tons N, bringing overall nitrogen capacity to 5,000,000 tons or more by the end of 1962.

•

NFSA To Meet Oct. 31

The National Fertilizer Solutions Association will hold its annual convention at the Edgewater Beach Hotel, Chicago, October 31 to November 2.

AG CHEM

Equipment, Supplies, Bulletins

Renneburg Equipment Folder

Edw. Renneburg & Sons Co., Baltimore, Md., is offering a bulletin that describes its processing equipment. Among the units described and illustrated in the bulletin are ammoniating and granulating units, conveyors, coolers, dryers, mixers, and pug mills.

Also described in the bulletin is Renneburg's pilot plant research and development center where the most effective processing methods are determined for various products. The bulletin, G560 AC, is available from the company.

•

Automatic Weighing System

A gross weighing bagger for free-flowing materials that tend to aerate is being offered by the Thayer Scale Corp., Pembroke, Mass. The bagger, G18R, fills 100-pound bags at rates up to three bags per minute.

•

Raymond Offers Catalog

The Raymond Division of Combustion Engineering, Inc., Chicago, is offering a 16-page, two-color bulletin on mechanical air separators. Described in the bulletin are the features of single and double mechanical air separators, plus detailed diagrams of the equipment available and pertinent technical data. The bulletin, Number Ninety, is available from the company at 427 West Randolph St., Chicago 6.

•

Range Fertilization Movie

The story of rangeland fertilization, much of it seen through the eyes of an aerial applicator, is told in a recent Ortho Agricultural Newsreel release. The movie outlines the important steps in a rangeland fertilizer program—good management practices, the use of marginal land, and the utilization of the extra feed that fertilization provides.

The film was produced for the California Chemical Co., Richmond, Calif., by Ingraham Productions, San Francisco. It is available on free loan for showing to interested groups from L. F. Czufin, manager of advertising and public relations for California Chemical Co.

•

Zonolite Conditioner

A new anti-caking product for mixed fertilizers is being offered by Zonolite Co., Chicago. Called "Conditioner BO5," the product is incombustible and is shipped in either bulk or bags.

•

Chemagro Guthion Brochure

A brochure illustrating fruit insects that can be controlled with Guthion insecticide has been prepared by Chemagro Corp., Kansas City, Mo.

Raven Fiberglass Tanks

Raven Industries, Inc., Sioux Falls, South Dakota, has prepared a brochure to describe its fiberglass tanks for crop spraying. Among the features listed for the tanks, which are available in 110 and 200 gallon capacities, are corrosion and contamination resistance, high strength, easy repair, and light weight.

•

Automatic Bag Printer

Bemis Bro. Bag Co., St. Louis, is offering an automatic bag printer that provides clear, uniform printing of product specifications or codes above the sewing line of sewn multiwall paper bags. The Bemis Bag Top Printer is mounted on a sewing pedestal and imprints the bag as it is being sewn closed. The printing speed is set by a variable speed sheave on the motor which is synchronized with the speed of the conveyor and sewing head.

Engineering specifications and operational data are available from the company's packaging service, 305-27th Ave., N.E., Minneapolis 18, Minn.

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Insect Wall Chart

Velsicol Chemical Corp., Chicago, is offering to dealers handling lawn and garden chemicals a giant-size wall chart that illustrates and describes more than 100 insects.

LISTENING POST

(*From Page* 66)

around the tree, and permitted the use of large amounts of water when necessary.

Cladosporium Spot

D. L. Strider (2), of North Carolina State College, writes that the acreage planted to southern pea (*Vigna sinensis*) in the mountain area of North Carolina has been reduced in recent years because of frequent severe losses resulting from attocks of Cladosporium spot, caused by the fungus *Cladosporium vignae*. Strider

investigated varietal resistance and use of fungicides as means of controlling the disease. In the fungicide experiments, he applied sprays of zinc ethylene bisdithiocarbamate (zineb), manganese ethylene bisdithiocarbamate (maneb), basic copper sulfate (Tri-Basic), and 2, 4-dichloro-6-(*o*-chloroanilino)-*s*-triazine (Dyrene). Maneb was superior to the other fungicides tested, but none gave adequate control. Strider concluded that a spray program for control of Cladosporium spot would not be economically practical and suggested that resistant varieties be planted where the disease is a problem.★★

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PEST ROUNDUP

(*From Page* 63)

in some central Arizona fields. In California, medium infestations of the insect were reported from alfalfa in San Luis Obispo County and heavy infestations from the Temecula area of Riverside County.

Boll Weevil Survival Survey

THE spring survey to determine the number of boll weevils surviving the winter was completed during March in most of the reporting areas. Woods trash samples were collected in Falls, Hill, Limestone and McLennan Counties, Texas. The average number of surviving weevils per acre of woods trash for the area was 1,516. This compares with a 1960 spring survival count of 2,065.

In Arkansas, collections were made in 7 counties along the Arkansas River in the western part of the state. Surviving weevils were found at the rate of 329 per acre of trash.

Collection of woods trash was made in the northeastern Louisiana Parishes of East Carroll, Madison and Tensas. The average boll weevil survival rate of the three-parish area was 2,193 per acre compared with 4,748 found in the 1960 spring survey. During the 1960 fall survey it was found that 11,487 weevils per acre of trash had entered hibernation. In Mississippi, the survey was conducted in the same four areas surveyed during the 1960 fall hibernation study. The survival counts for the state averaged 1,247 per acre of trash compared with a survival count of 821 in the spring of 1960 and 464 in the spring of 1959. The average number of live weevils in hibernation in the fall of 1960 was 14,502

per acre. In Tennessee, the boll weevil survival survey was conducted in McNairy County. A survival rate of 1,815 weevils per acre of trash was found. This is the highest carryover in the state since 1953, when the count was 2,200. In the spring of 1959 surviving weevils were 807 per acre.

Collection of surface woods trash to determine weevil survival in North and South Carolina was made in the same areas as those for the 1960 fall hibernation counts. In south central South Carolina the number of surviving weevils this spring was 376 per acre of trash, which is below the 861 found in the spring of 1960. Live weevils found in hibernation last fall were 3,308 per acre. Survival counts in the Coastal Plain area of North and South Carolina averaged 1,129 this spring compared with 1,049 in the spring of 1960. The fall hibernation count in this area was 13,148. The Piedmont section of North and South Carolina had a survival count of 1,558 weevils per acre of trash compared with the 1960 spring average of 590. Live weevils found in hibernation in the area last fall were 8,954. Four hundred thirty surviving weevils per acre of trash were found this spring in the north central North Carolina area. Last spring 377 live weevils were found and in the fall of 1960, 2,582 per acre wer ein hibernation.★★

FERTILIZER VIEWS

(*From Page* 49)

ford to neglect planning for it. The expected increase in population even within 25 years presents formidable problems when it is considered that the benefits of fundamental research require from 10 to 20 years to be realized and applied generally. The arguments of those who would suspend research in farm production because of current surpluses in grain seem so unrealistic. What we need is sustained, continuing research that will enable farmers to lower crop unit costs of production and improve the quality and the marketing of their products. Private and government research projects directed to these goals will enable our agriculture to satisfy the ever-growing needs of our vigorous, expanding population. Agriculture is our biggest single industry. The dollar value of agricultural production at retail is estimated at over $90 billion per year, or about 20% of our gross national product. Yet the total national investment in agricultural research—private and government – in the past year amounted to about $500 million, only about 5% of the total research and development expenditures for all purposes and from all sources. Too much research in agriculture? Nay! Not enough of it for our national good.★★

WEED CONTROL

(*From Page* 34)

to show and, because the application of herbicide is so close to the time these discoloration symptoms appear, many farmers blame the weed killer. It is not, of course, impossible to have damage to crops from herbicide use because, aside from mistakes or carelessness, some soils have to be treated much more carefully than others. We had one field in which very definite discolorations appeared during two different years following Monuron applications. In one of these years, we lost some plants in the cotyledon stage from the residual effect of the material. Last year, we used Diuron on this field and suffered no effects on the cotton at all.

In 1958, we operated our own spraying rig and last year our weeding bill was $10.00 per acre, including the cost of the material, and our own cost of application. This is quite a difference from the $34.20 per acre it cost to weed by hoeing in 1955.

Herbicide materials, of course, are not to be taken lightly and applied carelessly. I still worry quite a bit after applying herbicides, but I don't worry half as much as I

did when we had 50 to 100 men in the fields trying unsuccessfully to hoe out the morning glories. I would not want to farm without herbicides now.

There is no particular secret to doing a good job with herbicide materials. We do not have an expensive spraying rig. Our existing sprayer was equipped with a good mechanical adjustor so, by purchasing a high trailer and booms, screens, and nozzles, we were able to make a spray rig with an investment of less than $600. The most important thing for us to remember is to use herbicide materials according to the book. We have tried to take short cuts and save money twice and it has ended up costing us more each time. We have tried irrigating every other row, hoping the rain would wet the other row enough to get results. Well, it didn't rain last summer and the field I tried this on cost me almost as much as the profit I was making on the other fields on which I followed recommendations and irrigated every row.

Up to lay-by time, we use the old conventional methods of cultivating and hoeing. We have been using the spring or rod weeders as soon as the cotton is large enough to withstand the pressure, and they have helped tremendously to keep the morning glories down before lay-by. In an attempt to take another short cut, I applied herbicides on a field that was not clean of weeds before the application. I had seen large morning glories turn yellow and die other years, so I thought I would take a chance and save a hoeing. Most of the large morning glories turned yellow, but later in the summer they seemed to recover. It cost me quite a bit more later to weed these big vines so that they would not smother my plants completely.

Another mistake I have made is not covering enough space outside my outside row in the skip-row fields. We did a better job last year by using a wider angle nozzle, but there is room for improvement.

Following recommendations in our weed control program has helped to maintain the net income of our farm at a favorable level. Much of the credit for the success of our operation, therefore, must go to the research people who are responsible for the recommendations.★★

STABILIZATION

(*From Page* 43)

activator before it is combined with the methyl parathion. It is important that the diluent have a pKa greater than 3.3. If it does not, it, too, should be deactivated with a neutral deactivator before it is combined with the methyl parathion.

Under many circumstances, HMT is a satisfactory deactivator for surface active carriers used with endrin. However, when endrin is to be combined with methyl parathion, the possibility of alkaline hydrolysis can be avoided by the use of a neutral type deactivator

such as a poly-glycol. If physical properties such as the bulk density and flowability of diluents such as talc and calcium carbonate are acceptable, it is preferable that these materials be used in cut-back formulations, because of their lower cost and little or no requirement for deactivation.

In the development of processes for the manufacture of dry formulations, practical consideration must be given to the order of addition of the formulation ingredients. Because some toxicants are decomposed very rapidly when in contact with catalytically active diluents or carriers, they must be deactivated before the toxicant is added and tested with the appropriate indicator for completeness and uniformity of deactivation. Some carriers are deactivated slowly and may require up to an hour or more before the indicator test shows it to be safe. Grinding the carrier with the deactivator before adding the toxicant can frequently decrease the time necessary for deactivation to be completed.

It is hoped that further research on the mechanisms of toxicant decomposition initiated by mineral carriers will result in further improvements in deactivator systems.★★

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Mr. Ordas points out that his paper is a *review* of the published work on dry pesticide formulation and the references cited are the only authorities for the data which have been included.

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SAFETY FACTORS

(*From Page* 55)

4. He should not take things for granted and should not neglect his pre-take-off drill. The extra money from the extra sortie squeezed out of the time saved will not buy him another neck.

5. A pilot should not fly with his wheels in the crop. It is not really necessary, and there are enough calculated risks to cope with without adding silly ones.

Operator

1. An operator should purchase good equipment. It is difficult for his pilots to make money for him with old and worn-out tools.

2. Good engineers and servicing methods should be employed—it will pay off handsomely in the long run.

3. Operators should not ask pilots to take unreasonable risks; calculated risks, to which the pilots agree, of course, but it should be remembered that a few dollars of extra profit will not bring a dead pilot back to life.

5. Operators should give some thought to the creation of a team atmosphere and spirit in their organizations. It will make them richer in the end.

There is no black magic about agricultural aviation, but success will accompany the team in which the members are able to take a broad and sympathetic outlook on the problems of other members of the team.★★

HOME GARDENS

(*From Page* 27)

very helpful to retail dealers in this regard.

Among selling aids that the manufacturers and distributors can offer to retail dealers are the sponsoring of such events as open houses, garden clinics, and grand openings. In addition, distributors often can assist in the arrangement of displays.

A system of "planned orders" being used by many regional distributors of garden supplies involves the distributor's taking complete charge of the dealer's garden department. The distributor sells its line of garden chemicals and equipment to the dealer and then follows through with display work, clerk training sessions, inventory maintenance, and replacement of stock. In the case of the Richmond Power Equipment Company, this method has been successful and has made the planned order a thing of great importance to them. Their salesmen do not have to write an order, mower by mower, tool by tool, and chemical by chemical. They simply present a planned order covering all the products. Samples are carried and demonstrated by the salesmen during the season to help get larger re-orders, but records are maintained on each dealer so that, in future seasons, the salesmen can present to the dealer the figures showing what he actually sold during the previous season.

It has been estimated that 1,750,000 new homes will be built each year during the decade of the '60's, and 2,250,000 per year during the decade of the '70's. With this prediction as a basis for optimistic appraisals of future small-package markets, there is solid foundation to the growing belief that sales to home gardeners need no longer be treated as a sideline.★★

ACS MEETING

(*From Page* 21)

appear. A study of geographic patterns of plant location would indicate that while plants tended to be heavily concentrated in a few locations in 1940, they are currently spread throughout the country.

Further evidence of growth of competition in the industry is offered by the price history for the important nitrogen products during the post-war period. For example, during the period 1953-1960, the price of anhydrous ammonia changed seven times. It might also be noted that despite the major inflationary trend in the economy during the post-war period, the price level for nitrogen increased at a far slower rate than

that for the economy as a whole. From 1940 to 1960 the ammonia price level rose only about 40% as compared with an approximate 50% rise in the Bureau of Labor Statistics' Wholesale Price Index.

Because few firms are highly specialized in nitrogen products, it is difficult to determine from corporate statements anything about nitrogen profits for recent years. A reasonable guess, observed Mr. Abrahams, based on certain firms, is that profits in nitrogen have been generally favorable.

It should be noted that the growth of competition in the industry has taken place in the face of contrary predictions by almost all observers. For example, two well known economists, George Stocking and Myron Watkins, felt quite certain in 1946 that the cartel conditions of the 1930's would return as soon as the post-war buyer's market in nitrogen terminated. The FTC was still voicing these fears as late as 1950. Surprisingly, even the very conservative American Farm Bureau Federation was pressuring for a national fertilizer program in the early post-war period, due partially to fears of this type.

The following is a listing of some possible reasons for growth of competition in the industry that have been suggested by different observers:

1. The antimonopoly program and other actions of the U.S. government.
2. The high level of demand for nitrogen in the post-war period.
3. The breakup of I. G. Farben.
4. The TVA fertilizer program.
5. Desire for diversification by producers.
6. Integration opportunities for producers.
7. Technological developments in the industry.

Mr. Abrahams indicated that the nitrogen industry case serves to illustrate an interesting example of the decline of monopoly and the growth of competition resulting from largely natural economic events. "While the government's role has certainly had some effect, it would clearly seem that technological factors have been paramount."★★

AMMONIATOR TECHNOLOGY

(*From Page* 47)

ner similar to an ammoniator, he will notice that the main body of the bed travels upward in a broad band next to the shell, and spills downward in a narrow band at a much higher speed. Between the two layers moving in opposite directions is a core or "eye" that rotates more slowly than either layer, as illustrated in Figure 5. The size and position of this eye varies with the depth of the bed, the speed of rotation of the cylinder, and the plasticity of the bed. The eye becomes larger at slower speeds, with deeper beds, and with increased plasticity of the bed.

The slow rotational speed of the eye tends to overagglomerate particles, resulting in the formation of large pellets within the eye. The more pronounced the eye, the greater will be the range in particle size of the discharge from the rotating cylinder. The simplest way to decrease the size of the eye is to decrease the depth of the bed.

However, a shallow bed in the average granulating drum does not roll, but slides back and forth. The lack of a rolling bed minimizes agglomeration and results in poor granulation.

The intermediate dams discussed in the preceding section are especially advantageous in a granulating drum. As long as the dams are spaced a distance equal to four times the height of a dam, a rolling bed of any depth will exist along a cylinder of any desired length.

For example, in a granulating cylinder six feet in diameter, a set of intermediate dams six inches high on two foot centers will provide the intensive rolling action in conjunction with a small eye so that the range of particle sizes is decreased, while the length of the cylinder can be chosen to be that necessary to firm the particles at the desired rate of production.

Many plants use the feed end of a drier containing no flights as a granulator. It has been found that the insertion of intermediate dams in the smooth walled section of a drier is a definite aid toward granulation.

An interesting article in a British publication (4) indicates that probably most of us have been running our ammoniators at too low a speed of rotation. The author suggests that a granulating drum should be rotated at one-half the critical speed to yield a product with the least variation in particle size.

Critical speed is defined as $76.5/\sqrt{D}$ where D is the drum diameter in feet.

Mr. Hignett of TVA stated at the 1960 Round Table that TVA's data indicated one-third critical speed as best when spargers are located underneath a bed of solid phosphates; while one-half the critical speed was best when spargers are located above the bed.

As more people study rotary ammoniators and granulators, more data will be obtained that will narrow the present range of variables that affect operation. It is believed that the use of intermediate dams is a step in this direction.

To Be Continued

PESTICIDE OUTLOOK

(*From Page* 19)

farm more acres. Pesticides are being sold to smart managers, who follow good practices, such as investing in proper equipment and using plenty of chemicals. The farmer market is getting smaller, but more farmers are seeing the value of the pesticide industry's products. In many areas, alert farmers are seriously examing their traditional purchasing methods. Some are purchasing technical grades of pesticides, bypassing dis-

tributors and commercial formulators, and are doing their own formulating.

The upshot of it all is that the Department of Agriculture now predicts a 20 per cent rise in pesticide use by the mid-1960's. In the background is the vision of new things to come—new chemicals to control pests more efficiently and more versatile chemicals to replace those with limited use. The cost of development of a single chemical—now over one million dollars—can be recovered by stressing versatility.

During the past 20 years, the pesticide business has grown seven times. During the next 20 years, the business will increase tenfold. This is because agriculture has increased its productive capacity many times by using pesticides. Only by further increasing its use of pesticides will it increase productive capacity to meet the demands and needs of consumers in an expanding population. Estimates of crop losses from uncontrolled pests total 9 billion dollars annually. A sales volume of only 290 million dollars of pesticides hardly scratches the surface of the need that exists.★★

GRANULAR PESTICIDES

(*From Page* 33)

be loaded with fines and bear little relationship to the original carrier in mesh analysis. If the mesh range is indicated on the package of a finished pesticides, as has been proposed, the mesh determination should be made on the finished formulation and not assumed to be identical with that of the original carrier.

The degree and rate of mechanical breakdown of the granules in water or moist soil differ greatly between the RVM and LVM types. The RVM granules disintegrate or turn to mud fairly readily, while LVM granules are resistant to this disintegration. There is a test method to determine degree of water breakdown described in the Federal specifications covering granular insecticides for fire ant control. Degree of water breakdown of the granular product is influenced not only by the carrier but by the pesticide chemical, the solvent, and other additives. It is assumed that the release and distribution of the toxicant itself after application in the field are directly related to water breakdown characteristics, but this is not a clear picture and probably varies greatly with different pesticides. It is obvious that environmental conditions during and subsequent to application, such as soil moisture and rainfall, exert an influence on release and distribution of the toxicant and, therefore, possibly on the degree of success of the control program.

Certainly, volatility and solubility in water of the toxicant and its concentration on the granules would be expected to influence its release from the carrier and its distribution in soil or water. The nature and amount of organic solvent present in the formulation and many other factors affect toxicant release. A study[2] of release of organic phosphate ester insecticides from absorptive carriers in columns of water has indicated that rate of toxicant release bears a direct relationship to volatility and concentration of solvent, but an inverse relationship to particle size. Magnitude of surface energies inherent in adsorption also might play a great part in toxicant release, and these adsorptive forces would be expected to vary specically with different toxicant chemicals.

Sorptive carriers, such as attapulgite, are somewhat hygroscopic in nature, and the question concerning possible adverse effects of free moisture on sorptive capacity naturally comes to mind. Actual

[2]Criteria for Selecting Granular Insecticides for Vector Control, Mir S. Mulla, University of California Citrus Experiment Station, Riverside, California, 1960.

test results with attapulgite indicate very little adverse effect, calculated to sorptive capacity on the bone-dry clay basis, up to about 5% free moisture content. Up to that limit, an increase in free moisture of 1% would mean 1% less actual bone dry clay per unit weight of the carrier and a reduction in sorptive capacity of about 1%. If the practical sorptive capacity (total of adsorption and absorption) of a carrier for a pesticide composition is 30%, then a 1% increase in free moisture might be expected to decrease this sorptive capacity by 0.3% to a resultant 29.7%. Above the 5% level, additional free moisture seems to exert an adverse effect about one and one-half times the effect up to the 5% level. If a fresh attapulgite carrier is impregnated with a pesticide composition and sorptive capacity is fairly well satisfied, hygroscopicity no longer is a very important factor.

It is doubtful that the actual requirements for most effective pest control in the field are known in most cases. Release and distribution characteristics of different pesticide chemicals vary greatly, and even the basic manufacturer of the chemical may not have a clear understanding of this. Certainly, the toxicant distribution requisites would be expected to differ in the cases of controlling an active subterranean insect which moves about in the soil, and of killing a germinating weed seed which is fixed in position. Too often, an experimental formulation with a certain size and type carrier was arbitrarily made up and later became the basis for a restrictive standard. More should be known concerning these biological criteria, actual chemical and physical requirements for optimum biological control, before unreasonable specifications are imposed on the carrier manufacturer and pesticide formulator.

Perhaps this article has raised many questions and provided too few answers. It is hoped that some of the problems have been defined and some clues to answers provided. Most of all, it is hoped that the existence of many technical facets to the problem has been demonstrated and the need for cooperative consideration by all the various groups involved has been proved.★★

LIQUID FERTILIZER

(From Page 24)

program over Crookston's radio station, KROX. The program involves farm news, local chatter, and information on liquid fertilizers. Mr. Cochrane, by the way, acts as both announcer and programmer for the 15-minute show.

With an eye on the future, Crookston recently added a fourth meter to the Autobatch panel. The new meter, to be used for adding nitrogen solutions, is regarded as an increasingly important component as liquid fertilizer formulation becomes more complex. The company also is considering the installation of automatic routing controls, now standard on the B&L but not available when their plant was installed.

The Minnesota firm has more storage tanks than many liquid manufacturers because Crookston is "a long way up". For example, acid comes all the way from Lawrence, Kansas. Acid storage includes one huge 80,000 gallon tank and two smaller units. Total tank capacity for raw materials at Crookston is 260,000 gallons. There are a number of tanks for finished product storage — totalling about 160,000 gallons. Dealers account for another 300,000 gallons of finished product storage.★★

II-33-0 PRODUCTION

(From Page 18)

as the result of hydrolysis salting out will occur at a higher temperature.

Storage Properties

Liquids that contained 50 per cent or more of the total phosphate as polyphosphates have stored satisfactorily for more than a year at

room temperature and at 32° F. without salting out. Liquids that contained as little as 40 per cent of the total phosphate as polyphosphates usually stored for more than a year at room temperature, however, they usually salted out in 1 to 3 months at 32° F. Samples of 190 shipments of 11-33-0 were stored at 32° F. Two of these samples salted out in 1 month, six in 2 months, and, by the end of 6 months, twenty-five had salted out. The polyphosphate contents of these liquids ranged from about 40 to 47 per cent of the total phosphate.

The nominal 11-33-0 grade liquid has been shipped to forty-five companies in nineteen states for use in the production of high analysis liquid fertilizers and as a sequestrant in the production of high-analysis liquid fertilizers and as a sequestrant in the production of liquid fertilizers from wet-process phosphoric acid. Only minor difficulties have been experienced with salting out; these difficulties occurred in extremely cold weather with products that were low (about 42%) in polyphosphate content.

After about 2½ years of operation, consideration is being given to changing the grade of the liquid from a nominal 11-33-0 to a 10-34-0. The latter grade has better storage properties at low temperatures (down to 0° F.) because of a combination of maximum solubility in the pH range of 5.8 to 6.0 and good supercooling properties.

Acid Specifications

In order to produce a liquid that contains at least 50 per cent of the total P_2O_5 as polyphosphates, the acid used should contain at least 76 per cent P_2O_5 (*1*). The crystallization temperature of superphosphoric acid is about 60° F. at a concentration of about 76.0 per cent P_2O_5. However, the acid has a strong tendency to supercool, and it can be exposed to lower temperatures for considerable time without much danger of crystals forming. Provision always should be made for heating superphosphoric acid in the event that it should crystallize.

Agronomic Value

Agronomically, when considering both published (*2*) and unpublished data, the P_2O_5 in liquid fertilizers made from superphosphoric acid is at least as effective as that in concentrated superphosphate and other water soluble solid fertilizers.

Conclusions and Discussion

For best results in the production of liquid fertilizer from superphosphoric acid, a heel of previously prepared liquid first should be charged to the reactor so that vigorous agitation can be established. The formulated amounts of ammonia, superphosphoric acid, and water then should be added simultaneously so as to maintain the desired pH (6.0-6.3 for 11-33-0; 5.8-6.0 for 10-34-0). The water addition should be controlled so that the specific gravity of the liquid is about 1.342 at 180° F. for 11-33-0 or 1.338 for 10-34-0.

The superphosphoric acid should contain at least 76 per cent P_2O_5 so that at least 50 per cent of the total phosphate in the product is present as polyphosphates. It is important that superphosphoric acid not come in contact with water before ammoniation since the polyphosphates will hydrolyze to orthophosphate.★★

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FERTILIZER CONSUMPTION

(*From Page* 37)

cent) of the nitrogen, 523,000 tons (20.4 percent) of the available P_2O_5, and 271,000 tons (12.1 percent) of the K_2O. Of these nutrients, only nitrogen was supplied in increased amounts, principally through increased use of anhydrous ammonia, nitrogen solutions, urea, and the ammoniated phosphates. Decreases in the consumption of P_2O_5 and K_2O in direct application materials largely were associated with decreases in the direct use of basic slag, calcium metaphosphate, phosphate rock, and potassium chloride.★★

FARMER ATTITUDES

(*From Page* 15)

tilizer application indicates that many farmers perceive fertilizer cost as prohibitive to higher application or they may feel they already are using optimum fertilizer levels (few actually are doing so.) Responses to the sentence completion question, "I'd use more fertilizer, but . . .," are shown in Table I.

The chief anxieties of farmers regarding fertilizer use are burning their crops, getting proper application, and obtaining the greatest return from their fertilizer investment. Undoubtedly, more complete information about fertilizer on such topics as fertilizer placement, and the elements of plant nutrition could help to neutralize many of these negative attitudes.

Table II shows farmers' source of information about fertilizer. Fertilizer dealers and salesmen were named by 32 per cent of the farmer respondents as their most important source of information. This indicates greater importance for commercial sources of information than has been found in previous studies.

This Ohio State fertilizer use demonstration study illustrates the level of cooperation that can be obtained among industry, extension, and research workers and the far-reaching effects of such cooperation. In spite of the general trend of American farmers to use higher rates of fertilizer applications, they still do not use optimum amounts. Many farmers are using much less fertilizer than the amount that would net them the best returns in relation to other crop production tools. The dramatic increase in fertilizer use achieved in Miami County in only two years is an indication of the results that might be expected from large-scale cooperation between industry and agricultural extension.★★

DEFOLIATION

(*From Page* 60)

supplies in the soil are excessive at the time of defoliation, or if too long a time elapses between defoliation and picking. This, in turn, may result in green-leaf stain in machine picked cotton. This problem can be held to a minimum through careful attention to the factors discussed above.

Effects on Fiber Quality

Any discussion of defoliation would be incomplete without some mention of effects which defoliation has on fiber quality. Favorable effects—more rapid drying and opening of mature bolls, fewer green leaves and general debris, reduced boll rots, etc.—are well known and appreciated. Possible unfavorable effects on fiber quality merit a few comments, however.

Defoliation or desiccation has no deleterious influence on cotton in bolls which are open or which are fully mature, although not yet open at the time of defoliant application. This was the conclusion drawn from results of 11 tests in five states over a three year period reported by Tharp, Thomas, Walhood, and Carns.[2] Premature defoliation had a definite effect on some fiber properties, but no ob-

servable effect on others. The effects which were reported are summarized below:

Length. The upper half mean length of cotton fibers was not significantly affected.

Strength. Effects of premature defoliation on fiber strength were variable. In no case were the fibers weakened, and in some cases significantly stronger fibers resulted.

Fineness. In 6 of 10 tests, premature defoliation resulted in significantly finer fibers.

Spinning Qualities. Yarn skein strength was not consistently altered by premature defoliation.

Yarn appearance was not consistently altered when tests were viewed on a total crop basis. Considering only effects on late-harvested cotton, however, a distinct trend toward lowering of yarn appearance grade was noted where cotton was defoliated prematurely.

Picker and card waste also showed little effect of premature defoliation, but there was a trend toward increased waste on early-defoliated, late-harvested cotton.

Neps were rather consistently increased by early defoliation.★★

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EDITORIAL

(*From Page 13*)

suppliers, who compete against co-ops for markets among farmers, have long complained that this puts them at a serious disadvantage, and also deprives the government of needed tax receipts. And it is always worth remembering in connection with taxes that when one group of citizens gets off without paying taxes they should pay, the rest of us must pay more than our fair share.

The President feels that the law should be clarified to require patrons of co-ops to pay a tax on earnings allocated to them as dividends or refunds, even if they don't actually receive them. This would put an end to the practice of co-ops retaining the earnings as a free source of corporate capital, and no tax being paid to the federal government. Such a change in tax policies, we feel, has long been needed.★★

For Sale:

ROTENONE 5% EMULSIFIABLE CONCENTRATE. First quality guaranteed analysis material. We have a surplus of 2300 gallons left from a Government contract, priced dollars per gallon under the market. Colorado International Corp., 5321 Dahlia Street, Denver, Colorado.

WANTED: Used Tyler Niagara 300 or Tyler Hummer Screen in good condition. Box 307, c/o Agricultural Chemicals.

AG CHEM

CLASSIFIED ADVERTISING

Address all classified replies to Box Number, c/o Agricultural Chemicals, P. O. Box 31, Caldwell, N. J.

Rates for "Help Wanted" advertisements are 20¢ per word; minimum charge $3.00. Rate for individuals seeking employment is 5¢ per word, $1.00 minimum.

Advertisements of machinery, products and services accepted at rate of $10.00 per column inch. Minimum space, one inch.

Copy closing date, 10th of preceding month.

Checks must accompany all orders.

Situations Wanted:

CHEMICAL SALESMAN desires to relocate. Twelve years experience. Five years specialized in agricultural chemicals, insecticides, and fungicides sales. Proven sales and administrative abilities. Wide contacts: consumers and industrial. Three years college, majoring in accounting, chemistry and science. Presently employed, but seeking challenging position with potential for growth. Excellent references. Address Box 305, c/o Agricultural Chemicals.

ADVERTISING MANAGER, Over twenty years advertising agency experience. Four years on large agricultural chemical account. Fully familiar with all facets of advertising, sales promotion and public relations, art, production, writing, media and marketing. Write Box 309, c/o Agricultural Chemicals.

Help Wanted:

EXPERIENCED MANUFACTURING REPRESENTATIVES covering fertilizer and insecticide industry invited by national company to submit resumes and territory covered. New patented product with tremendous potential now available after completion of three year development program. Address responses to Box 306, c/o Agricultural Chemicals.

For Sale:

FOR SALE

2—Louisville 6' x 30' steam-tube dryers
2—2750 gal. T316 Stainless tanks.
4—2250 gal. T316 Stainless tanks.
5—Ing.-Rand 6" x 5" T316 Stainless cent. pumps.
6—36" Aluminum filter presses, 65 cham.
1—Rotex 40" x 84", 2-deck screen.
1—Worthington 70 cu. ft. rot. batch blender.
1—Raymond 66" 6-roll mill, rebuilt.
1—Raymond 50" 5-roller hi-side mill, oil journals, double whizzer
3—National 10' x 78' dryers. ⅝".
2—Davenport 8' x 60' rot. dryers, 7/16" welded shell, comb. chamber, burner.
1—7'-6" x 62' rotary cooler, ½" welded.
2—Bonnet 7' x 60' rot. dryers, ⅝" shell.
2—Bonnet 6' x 52' rotary dryers, 5/16".
1—Louisville 4'-6" x 25' steam-tube dryer.
2—18,000 gal. vert. alum. tanks.

LARGEST STOCK OF ROTARY DRYERS & COOLERS — Send for Circular #860-A

LIQUIDATION

OMAHA, NEBRASKA

1—Prater Blue-Streak hammermill.
4—Forester hammermills, size #8, 6.
3—Davenport #1A dewatering presses.
4—Davenport #2A dewatering presses.
5—Buflovak 42" x 120" dbl. drum dryers.
3—Shriver 48" C. I. filter presses, 50 ch.
2—Allis-Chalmers Inter-plane grinders.
8—Allis-Chalmers dagerminators.

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NORTH LITTLE ROCK, ARK.

Nitric Acid Synthesis plant — 90 ton per day design capacity. 135 ton per day peak capacity. (3) identical lines with compressors, boilers, burner-preheaters, Stainless Steel tanks, condensers, absorbers, pipe, all controls, etc. Designed by Chemical Constructors. Excellent condition. Separate concentrating plant available.

800 ACRE COMPLETELY DEVELOPED SITE WITH ALL UTILITIES!

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PERRY EQUIPMENT CORPORATION
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SALES MANAGER

An expanding Canadian organization with Head Office located in Western Canada requires a person to plan, organize, and develop a co-ordinated sales and service program for the provinces of Ontario, Quebec and the Maritimes. Home office will be in Toronto.

Initial responsibilities will include market research, distribution, promotion, and sales of agricultural chemicals.

QUALIFICATIONS — The successful applicant should have a B.Sc., in Agricultural Chemistry or Agronomy, with a minimum of 3 years' successful sales experience, preferably in a bilingual area. An introduction to sales analysis, forecasting, and budgeting as asset.

Apply in writing stating qualifications to

Box 308, c/o Agricultural Chemicals

All applications will be treated in confidence and acknowledged.

WANTED:

far-sighted salesmen to sell new fertilizers a new way in the Midwest

Effective October, 1961, fertilizers will be sold a new way in the Midwest. They will be sold as part of a program. A program tailored to specific soils and crops, that begins with planting and follows right through to plentiful harvest. In short, an ORTHO fertilizer program.

What is this new way of selling?

To put it simply, it is selling *results*, rather than a product. It is selling the increased yields and higher profits fertilizers can bring, rather than fertilizers themselves. ORTHO has sold fertilizers this way in the West for years, with outstanding results. The ORTHO fertilizer program is something farmers have come to rely on. Soon, for the first time, the kind of fertilizers used in an ORTHO program will be available in the Midwest. They will be made in an entirely new way, by an exclusive process, at a huge new 22 million dollar facility being built at Fort Madison, Iowa.

What kind of man is needed to sell them?

First and foremost, he must be interested in doing something for somebody else. Because this man's whole premise in selling ORTHO fertilizer in an ORTHO program is to *help the farmer increase yields, and make money* with the products he sells. Because the company he will work for—the California Chemical Company—is not just interested in sales today. They are interested in the long-term growth of agriculture in the Midwest. Education? A college degree or the equivalent. Experience? At least two or three years of successful selling.

What does this company offer him?

Most important – rewarding work. The ORTHO slogan is "Helping the World Grow Better". Men who work for this company will be doing exactly that. Opportunity for advancement is unlimited. A man can grow within, and *with*, a company which – already a world leader in agricultural pesticides – is heading for new horizons in the exciting field of petrochemicals. Fringe benefits are far above average—the same as those of the parent company, Standard Oil Company of California. Applicants are being hired right now. Send resume of experience, with a letter outlining long range aims and ambitions, to Mr. E. H. Solinsky, California Chemical Co., Ortho Div., 200 Bush St., San Francisco, Calif. Replies will be held in strict confidence.

ORTHO®

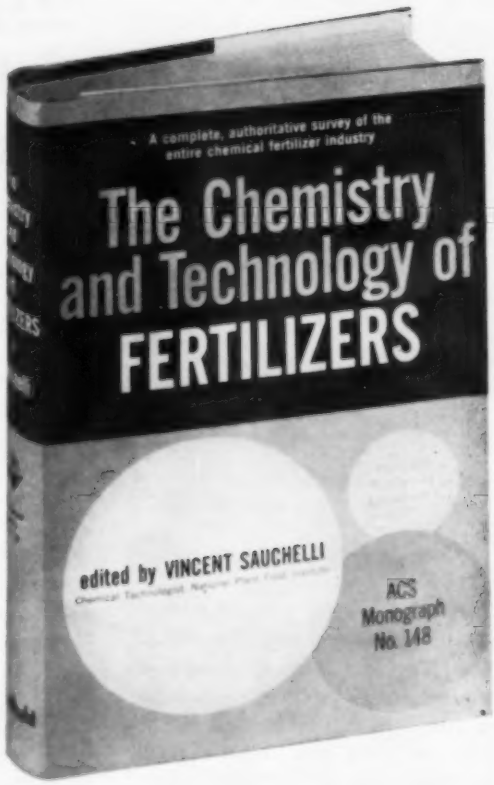
HELPING THE WORLD GROW BETTER

An authoritative survey of the entire chemical fertilizer industry

The Chemistry and Technology of FERTILIZERS

edited by VINCENT SAUCHELLI

Chemical Technologist, National Plant Food Institute



HERE is a complete survey of the chemical fertilizer industry. Leading authorities in the field discuss the raw materials used in chemical fertilizers and the conversion of these materials to suitable chemical compounds for the feeding of crop plants.

Among the topics discussed are the factors controlling the preparation of conventional mixed fertilizers, the caking problem, the theory and practice of drying and cooling fertilizers, liquid fertilizers, and corrosion and methods of preventing it in the manufacturing process. Extensive coverage is given to phosphate ore, its mining and processing. In addition, the authors discuss nitrogen compounds, potash salts and granulated fertilizers. The book also includes a detailed description of the processing equipment used in a modern plant.

Broad in scope, accurate, completely up-to-date, this book is directed to the reader who is engaged or expects to be engaged in the fertilizer industry. It will be of special value to chemists, chemical engineers, plant superintendents, and to management charged with the responsibility of selecting efficient and economical processes for the production of fertilizers.

AGRICULTURAL CHEMICALS
P.O. Box 31
Caldwell, N. J.

704 PAGES
$18.00

Please send me ..... copies of "The Chemistry and Technology of Fertilizers" Edited by Vincent Sauchelli. I am enclosing ..... ($18.00 per copy)

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INDEX TO ADVERTISERS

AG CHEM

TALE ENDS

EVIDENCE that more and more attention is being paid by the agricultural chemicals industry to the exploding home garden market can be found in the May issue of *Reader's Digest*. An article by Frank J. Taylor discusses the history of garden pesticides and reports that "Today, as a result of invention and discovery, they (home gardeners) can at last expect to win the battle, (against pests) and without exhausting labor."

The article goes on to explain about the wartime discovery of DDT and BHC and recounts the factors that led to the development of such pesticides as methoxychlor, lindane, Malathion, Tedion, Chlordane, Dieldrin, and Captan. These chemicals not only *control* garden pests, but, in what must be the language of the home gardener, they "clobber," "knock out," "wipe out," "destroy," and "guarantee sudden death" to bugs. Mr. Taylor also lists some of the selective herbicides that are available for home use.

"Chemists and engineers," Mr. Taylor concludes, "have come a long way toward the lazy homeowner's ultimate dream of a garden as a bit of paradise that will take care of itself."

AC

In the same regard, "Chemical Week" last month reported that manufacturers of pre-emergent-type herbicides are conducting a promotional campaign to push sales into the $15 million per year range; half again the 1960 mark. The prime markets are in the Northern states, where crab grass is being widely advertised as the No. 1 turf problem.

Among the companies newly-entering the home-owner crab grass market are: Dow, with Dow Crab Grass Killer; Diamond, with Dacthal; Eli Lilly, with Greenfield Crab Grass Killer; Amchem, with No-Crab; and O. E. Linck, with Enz. And, the report states, more are coming

A word of caution, however, comes from a USDA representative who is quoted as saying that most homeowners don't need crab grass killers; they simply need to take better care of their lawns.

AC

Chemical sterilants — newest of the insect control methods—and a promising improvement on radiation sterilization, are being intensively studied at the Orlando, Fla., laboratory of the USDA's Entomology Research Division. Work there has turned up at least three promising compounds. They are ethylene imine derivatives that have previously been studied as cancer-fighting agents.

AC

China Pictorial, an English-language magazine published in Red China, continually tells of China's rich harvests and happy peasants in glowing terms that sometimes are at variance with reports of Chinese farm disasters and famine carried in the U. S. press. A photograph of people's commune members sowing winter wheat by a "streamlined" method shows three horses pulling what appears to be an extremely rustic harrow to which a hopper has been added. Another "excellent" farming method illustration shows the Pakuating Production Brigade disinfecting the land with 666 insecticide. The Brigade is shown using vintage hand-dusters.

AC

A Westville, Indiana, farmer last month was awarded 40 tons of fertilizers as the grand prize in Spencer Chemical Co.'s fertilizer "pledge" contest. The contest entry blank asked farmers to pledge to consult their fertilizer dealer about proper plant food use.

AC

The importance of Latin America as a potential market for chemical fertilizers is emphasized in the March 18 *Chemical Week*, which points out that the use of fertilizers in South America is only about 1 per cent of the economic optimum rate. There are, however, obstacles to be overcome before this virtually untouched market can be exploited. The great mass of the farming population is uneducated in modern farming methods and is too poor to invest in fertilizers or other production aids. In addition, overproduction of such basic crops as coffee and cotton tend to discourage more fertilizer use.

Because the fruit and vegetable crops were treated with

TRIANGLE BRAND COPPER SULFATE

Regular or basic copper sulfate should be mixed in insecticide-fungicide sprays and dusts to insure appetizing, attractive fruits and vegetables that consumers "reach for."

When used in fertilizers, Triangle Brand Copper Sulfate helps to enrich the soil, resulting in healthy, profitable crops.

Help your customers produce more profitable crops. Use regular or basic Triangle Brand Copper Sulfate in your fertilizer and insecticide-fungicide formulations... it will mean more money in your pocket!

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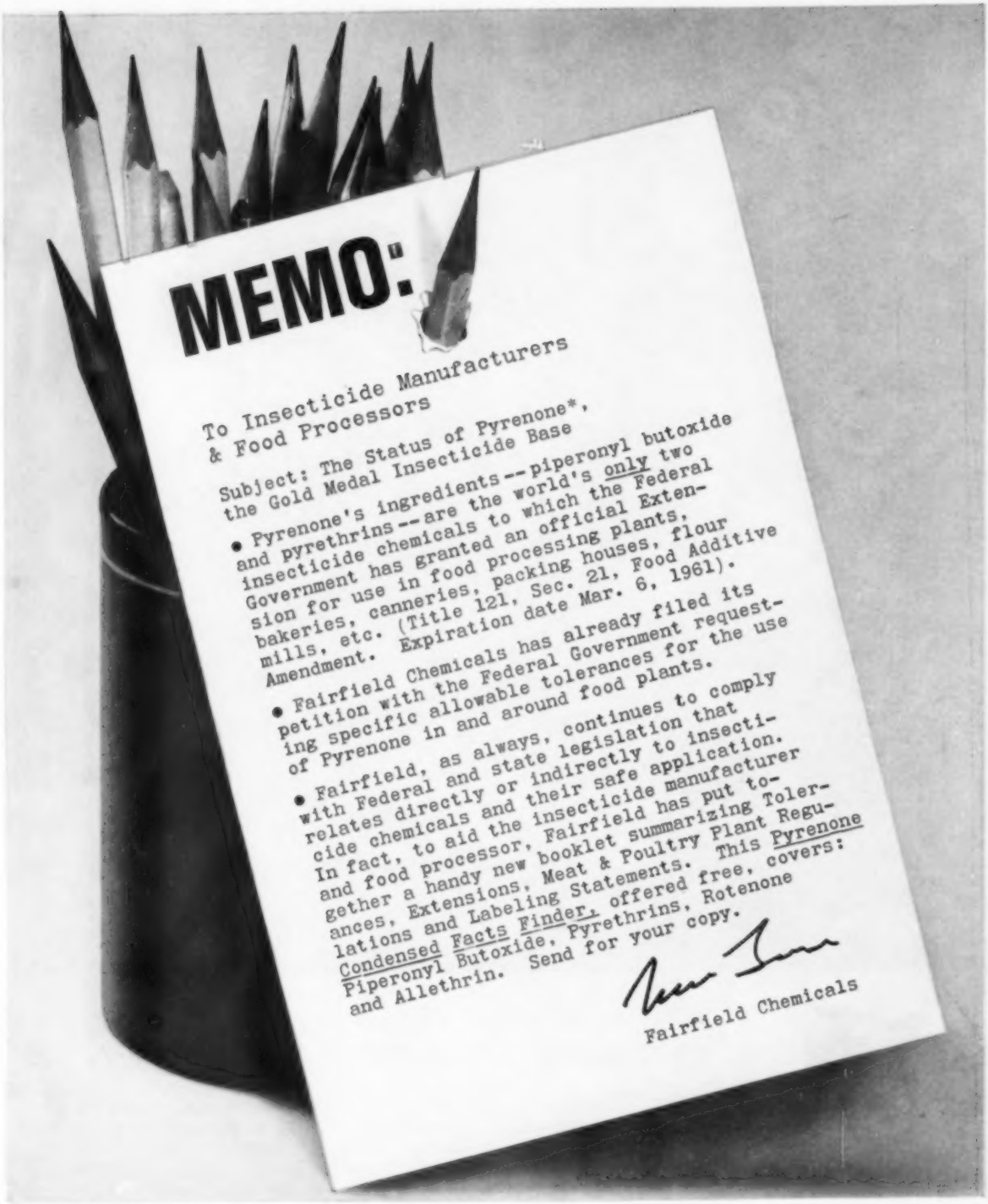

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